STUDIES IN AMERICAN TETTIGONIIDAE (ORTHOPTERA)

VII

BY JAMES A. G. REHN AND MORGAN HEBARD

A REVISION OF THE SPECIES OF THE GENUS ATLANTICUS (DECTICINAE)

The acquisition of certain very peculiar types belonging to this interesting genus, not referable to any of the generally recognized forms, made necessary not only the examination of all the material in our possession or in our charge, but also that in the other more important American collections. As a result we have been compelled to completely revise the classification of the genus, to correct the assignment of certain of the older names and to distinguish the more permanent from the many relatively variable, and therefore taxonomically valueless, characters found in the genus. Although the number of valid species in the genus has been considerably increased, but two were previously unknown, as a number of previously synonymized or incorrectly assigned names represent well characterized species, which are here correctly located.

ATLANTICUS Scudder

1838. *Decticus* Burmeister, Handb. der Entom., ii, abth. ii, pt. i, p. 709. (Part.)

1859. *Orchesticus* Saussure (not of Cabanis, 1851), Revue et Magasin de Zoologie, 2e ser., xi, p. 201.

1862. *Thyreonotus* Scudder (not of Serville, 1839), Boston Journ. Nat. Hist., vii, p. 453.

1893. *Engoniaspis* Brunner, Ann. Mus. Civ. Stor. Nat. Genova, xxxiii, p. 185. (No species described.)

1894. *Engoniaspis* Scudder, Canad. Entom., xxvi, pp. 177, 179. (No species described.)

1894. *Atlanticus* Scudder, Ibid.

1900. *Engoniaspis* Scudder, Proc. Davenp. Acad. Nat. Sci. viii, p. 96. (Genus properly characterized.)

1900. *Stipator* Rehn, Trans. Amer. Entom. Soc., xxvii, p. 90. (To replace the preoccupied genus *Orchesticus* Saussure.)

The genus was based on three species: *pachymerus* and *dorsalis* Burmeister and *gibbosus* Scudder.

GENOTYPE: *Atlanticus pachymerus* [*Decticus pachymerus*] (Burmeister), selected by Kirby, 1906.

Generic Position.—The position which was assigned to the genus by Caudell in 1908,[1] *i. e.* adjacent to *Stipator* of authors (vide page 44), appears to us to be the correct one. Without a more detailed study of all the related genera we can not analyze the features of relationship to the several allied North American and certain Old World genera. The chief feature of difference from *Stipator* of authors (*Pediodectes*, vide page 45) is in the possession by *Atlanticus* of distinct and continuous, though sometimes rounded, lateral marginal angles to the pronotal disk.

Generic Description.—Head not prominent, of medium size; fastigium moderately prominent, varying from one-third to two-thirds (*calcaratus*) of the width of the interocular space; eyes subcircular to flattened (cephalad) circular in outline, hardly to distinctly prominent. Pronotum large, much produced caudad over remaining thoracic segments and proximal section of abdomen; disk subdeplanate to well rounded in transverse section, in form slightly to greatly narrowed at or in cephalic third or fourth or narrow and subequal in width, cephalic margin of disk truncate to weakly emarginate, caudal margin subtruncate to strongly arcuate; lateral angles of disk always indicated, persistent, gently rounded or prominent and cariniform, median carina absent or indicated caudad; lateral lobes longer than deep, humeral sinus distinctly, weakly or not at all indicated. Prosternum with or without distinct spines. Mesosternal lobes angulate produced. Tegmina of male abbreviate, merely stridulating organs wholly or largely concealed under the pronotum, strongly vaulted in form, overlapping, with stridulating field well developed. Tegmina of female rudimentary and wholly covered by the pronotum. Wings vestigial. Limbs moderately robust. Cephalic femora with the ventro-cephalic margin

[1] Genera Insectorum, fasc. 72, Decticinae, p. 14, (1908).

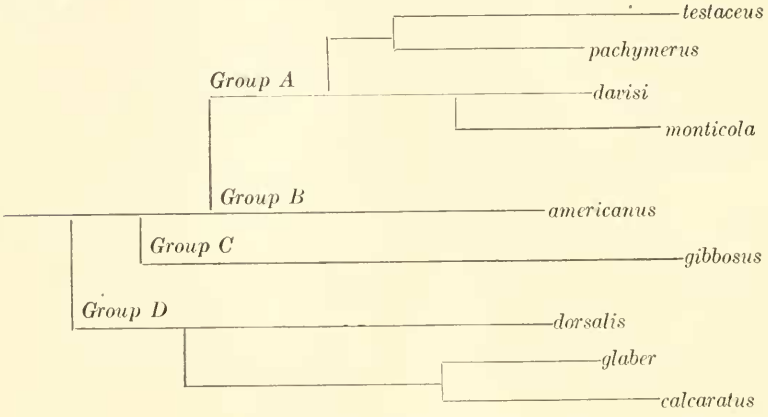
unarmed or with from one to five spines; cephalic tibiae armed dorsad on the external margin with but three (rarely four) spines. Caudal femora variable in length, proximal portion moderately to decidedly bullate, ventro-internal margin unarmed or with a number of spines; caudal tibiae with all margins well armed, dorsal ones with greater number, distal spurs with dorsal pair distinctly dorsal in position, median and ventral ones distinctly ventral in insertion, median pair of average or unusual length; caudal metatarsi with plantulae of short to great (*calcaratus*) length. Supra-anal plate small, trigonal to rounded in both sexes, seated in the emargination of the disto-dorsal abdominal segment. Cerci of male styliform, of robust or elongate type or corniform and elongate; tooth on internal face short and uncinate, elongate or corniform. Cerci of female simple and tapering. Ovipositor of medium or considerable length, straight, faintly or distinctly upcurved or very weakly decurved, apex on median line or ventral in position. Subgenital plate of male subtruncate to deeply fissate, styles varying from decided terete structures to mere nodes; subgenital plate of female always cleft, but this of variable degree and form, lateral portions of the plate ranging from rounded to lanceolate produced.

Classification.—The characters which stand out after detailed study as of diagnostic value are: the general form of the disk of the pronotum, the character of the caudal margin and the lateral margins and angles of the same, the relative depth compared with dorsal length of the lateral lobes of the same, the degree of projection of the male tegmina, the general character of the same, the form of the male cerci, the form of the subgenital plate of the female, the relative length and proportionate proximal inflation of the caudal femora and the character of the caudal tibial distal (particularly internal) spurs. In addition the degree of carination of the abdomen and the relative depth and general form of the ovipositor are features usually of diagnostic value, but not absolute for all the species, both showing variation in certain forms.

One of the striking things demonstrated by our study of the series of this genus is that the degree of development of the prosternal spines has little or no significance, as we find them well

marked or represented by mere nodes in individuals of the same species. Instead of being a character of prime importance, which has been used for the separation of genera groups, in the Decticinae the degree of development of these spines can not be used as a basic character, as we now know it is valueless as even a specific criterion in *Atlanticus* and, as Caudell has shown, in *Eremopedes*.

Our study makes it evident that the species of the genus fall quite naturally into four groups, our ideas of the general relationship of which, and of the component species, are as follows:



These groups may be in general characterized as follows:

GROUP A { *testaceus*, *pachymerus*, *davisi*, *monticola* }

Size medium to small. Pronotal disk with sharp lateral angles; disk proper distinctly constricted on cephalic third to fourth. Tegmina of male always with distal section not covered by the pronotum. Cerci of male moderately robust, with a distinct but short, approximately median, tooth. Subgenital plate of male angularly or arcuately emarginate, but never fissate. Subgenital plate of female moderately but never very deeply divided; lateral sections arcuate, obtuse-angulate or rectangular distad. Spurs of caudal tibiae normal.

Group B	(*americanus*)	Size medium to rather large. Pronotal disk with sharp lateral angles; disk proper distinctly constricted at cephalic third to fourth. Tegmina of male always with distal section not covered by the pronotum. Cerci of male moderately elongate, substyliform, acuminate, with an approximately median tooth. Subgenital plate of male fissate. Subgenital plate of female very deeply divided; lateral sections sublanceolate produced distad. Spurs of caudal tibiae normal.
Group C	(*gibbosus*)	Size large. Pronotal disk with distinct but rounded lateral angles; disk proper distinctly constricted at cephalic third to fourth. Tegmina of male almost or quite completely concealed under the pronotum. Cerci of male very elongate, corniform, tooth quite elongate and relatively slender. Subgenital plate of male subfissate. Subgenital plate of female moderately divided; lateral sections rounded rectangulate. Spurs of caudal tibiae normal.
Group D	*dorsalis* *glaber* *calcaratus*	Size medium to small. Pronotal disk with distinct but always rounded lateral angles; disk gently narrowing cephalad (*dorsalis*) or subequal and very narrow (*glaber* and *calcaratus*). Tegmina of male completely hidden under, or slightly projecting caudad of, the pronotum. Cerci of male short, robust, acutely pointed, with short stout median tooth. Subgenital plate of male acutely emarginate to subfissate (*calcaratus*). Subgenital plate of female moderately divided (female unknown in *calcaratus*); lateral sections moderately acute distad. Spurs of caudal tibiae elongate, straight for the greater portion of their length.

Of these, group B appears to be more nearly the probable ancestral type, group C being a strongly modified or rather specialized phylum, which probably diverged from the primitive stock before the more complex group A. The latter group shows in its *davisi-monticola* line a complex which is very dis-

tinctly breaking up, with the differentiation as yet visibly under way, and of the elements *monticola* probably represents the greatest divergence. The *testaceus-pachymerus* line is more permanent than the other line of the group, although the elements are more divergent. The species *pachymerus* appears to be breaking up at present. Group D is probably the oldest of the divergences from the presumably ancestral line, and in *dorsalis* we may assume we have the nearest to the primitive type of the group. The species *glaber* and *calcaratus* form a relatively old line of this group, but *calcaratus* is a much more specialized and differentiated form than *glaber*.

Notes on Male Tegmina.—The male tegmina are of use only as stridulating organs and are largely or wholly covered by the pronotum, the stridulating field proper being always covered, the portion which is exposed caudad of the pronotum in most of the species being the area distad of the speculum. The general form of the speculum and surrounding veins and areas shows some variation within specific limits, and again, in general character of the same, certain species show no important differences, but as a whole the form of the stridulating field is a good group character. The marginal field varies in form in certain closely allied species (i. e. *davisi* and *monticola*). The coloration of the tegmina is discussed under Coloration Notes. The tegmina of the female are small, pad-like, always completely hidden under the pronotum and of a general subcircular form.

Morphological Notes on Male Genitalia.—The disto-dorsal abdominal segment and the supra-anal plate of the male and of the female show a considerable amount of variation in form. The former is always emarginate mesad, but the same varies from an obtuse-angulate to an arcuate character, and within specific limits there is great variation in this respect. The supra-anal plate is more or less trigonal in character, but a tendency to become semi-elliptical is evident and this also is within specific limits. The same plate bears, usually, a medio-longitudinal sulcus, which may be complete or may be apparent only on the distal half. The cerci, as we have shown above under Classification, develop four principal types, one in each group, which are fairly or quite (*gibbosus*) decided and show no variation from their specific forms except in the following ways. There is a tendency to become more elongate or shorter and more

robust; another of the attenuation of the distal (distad of tooth) portion alone; a tendency to curve inward instead of remaining straight, which may involve the whole cercus or but the distal portion, and, faintest of all, a fluctuation in the curvature of the tooth. These features are liable to occur within specific limits, where we have sufficient material to permit us to speak with authority, except in *A. gibbosus*, which, while having the most complex cercus, is very fixed in these characters. The subgenital plate of the male has a very great amount of individual variability in the character of its distal margin, which ranges in a number of species from subtruncate to rectangulate and even acute-angulate. In one species (*americanus*) it is, however, invariably fissate.

Morphological Notes on Female Genitalia.—The disto-dorsal abdominal segment and supra-anal plate have been discussed above under the male genitalia. The cerci of the female are simple, tapering and without differential characters. The ovipositor shows variation along three lines: first, in relative length, secondly, in general straightness or curvature and in straightness or curvature of the ventral margin, and, lastly, in the position of the apex. In the matter of relative length, we find the variation exhibited is largely individual or possibly environmental, but not distinctly geographic. In several forms which have a faint decurvature of the whole ovipositor we find individuals which have the same straight (*pachymerus* and *davisi*), and this is probably (*pachymerus*) or certainly (*davisi*) geographic in character. The curvature or straightness of the ventral margin of the ovipositor is, of course, correlated with the general form, but to a slightly greater degree than the dorsal margin. The immediate apex of the ovipositor may be nearly median in position, but is generally ventral, the case in which it is median being geographic (northern specimens of *davisi*) and passing into the more normal type. The relative depth of the ovipositor varies somewhat, but this is chiefly in *davisi* and is there geographic. The form of the subgenital plate of the female is one of the most constant diagnostic characters found in the genus; this is always emarginate and ranges from subrectangulate and U-emarginate to V-emarginate, or subfissate (*americanus*) and divided well

toward the base (*davisi*), the lateral portions ranging from sublanceolate (*americanus*) to rotundate-rectangulate. In *davisi* the depth of the division of the plate is somewhat variable but the form is constant.

Notes on Pronotal Disk.—The disk of the pronotum is slightly different in the two sexes of the same species, in the female averaging more elongate with the caudal margin more truncate than in the male. This difference is, however, in large part nullified or at least modified by the character of variation found in both sexes. There is a very great amount of variation in the general form and proportions of the disk in at least three groups of species (A, B and C), or those with strangulate pronotal disks, this being purely individual, irrespective of sex and often the extremes are found in material taken at the same time and at the same locality. We find by measuring the greatest length, greatest caudal width and the least (at cephalic third) width of the disk we have three proportions no two of which seem to correlate with the third. In other words, two specimens of a series may show the same ratio of greatest width of disk to length of same, yet their least width will show no correlation to the other percentage but instead give widely different ratios. In a given species, by taking either of the width measurements, we find their extremes linked up by connecting intermediates of approximately the same disk length, so that there is no true dimorphism, but instead a wide range of variation in dimension of two portions of the same surface, yet these variations show no correlation.

General Morphological Notes.—In the present genus we find an interesting morphological condition to which attention has been called by Caudell, who found it present in the related genus *Eremopedes*.[2] The presence or absence of prosternal spines has been used by most authors as an important group character for separating genera in the Decticinae, but as Caudell has shown in regard to *Eremopedes*, and as we find in the present genus, these spines are not to be relied upon as invariable criteria. In certain species of the present genus (*davisi*, *monticola* and *americanus*) the spines may be represented by the merest

[2] Proc. U. S. Nat. Mus., xxxi, pp. 330 to 331, (1907).

nodes or by aciculate structures ranging to what would be considered long spines. In another species (*calcaratus*) the spines are completely absent and, although we have but two specimens of the species and cannot say how constant this feature is, this shows the condition which may occur in a genus supposed to be characterized by having strongly developed prosternal spines. The mesosternal lobes show an appreciable amount of individual variation in form in most of the species of the genus, the angle generally being submammillate. The abdomen almost always bears traces of a median and accompanying lateral carinae, which are sometimes continuous and again broken but indicated. There is, however, some variation in certain species in the intensity of the abdominal carinae. In several species the carinae bound color areas in individuals of certain color patterns. The caudal femora show as great a percentage of fixity in their general character and proportionate length as any of the more evident features of these insects. The only variation in femoral length seen, which is not correlated with general bulk, is geographic and can be demonstrated as such from the material in hand. The spination of the ventro-internal margin of the caudal femora is very variable in the number of spines present and we have found it of no diagnostic value. The spination of the cephalic and median limbs and of the caudal tibiae do not furnish us with any features of classificatory value. The spurs of the distal extremity of the caudal tibiae, and particularly of the internal face, do, however, give important features not previously utilized. These have been indicated under Classification (page 35).

Coloration Notes.—All of the forms of this genus are characterized in general coloration by somber or warm browns, red browns, or ochers, of a more or less protective character. The principal feature of the coloration, which modifies the appearance of individuals of the genus, is the presence of blackish fuscous as a wash on the dorsal section of the lateral lobes of the pronotum, and occasionally on a portion of the pleura and sides of the abdomen. This feature is variable in extent and depth and is frequently accompanied, when decided, with a fine stippling of the same fuscous over the paler area, but this fuscous

stippling may have no correlation with the intensity of the areas on the lateral lobes of the pronotum. Rarely the dorsum of the head, pronotum and abdomen has a pair of fine closely placed medio-longitudinal lines of fuscous (certain specimens of *glaber*). An invariable marking in the genus, although of variable extent and width, is the whitish area at the position of the humeral sinus of the lateral lobes of the pronotum. The general dorsal color may be washed with rufous or even bright green, but this is purely individual. Both *A. glaber* and *calcaratus* have their surface more glabrous or even polished than the other forms of the genus.

Distribution.—The genus is known to range from as far north as New Hampshire, northern Vermont (Sudbury), northeastern New York (Lake George), southern Ontario (Arner), northern Michigan (Porcupine Mountains) and Minnesota, south to extreme southern Florida, southern Alabama (Opelika) and Mississippi (Meridian and Natchez) and western Arkansas (Ozark region), and from the Atlantic coast west to Minnesota, Iowa, Missouri (record doubtful) and western Arkansas (Ozark region). It is quite probable that the genus will be found to reach the Gulf coast of Alabama, Mississippi and Louisiana, and also to extend into eastern Oklahoma. The Minnesota record is merely a state one and probably refers to the southeastern portion of the state. Two species of the genus have been reported by Bruner from eastern Nebraska, but his collection contained no material from that region and we have not positively accepted these records in consequence.

Individuals of this genus prefer woodland situations, living in the dead leaves and grasses, in low bushes and in wet meadowy areas near woods. They are occasionally found in numbers in low bushes along the edge of woods and at night we have found them climbing on the trees to a height as great as nine feet from the ground. Work with a flash-lamp will reveal them in many situations in wooded regions and they frequently fall victims to the molasses ground trap.

The center of distribution appears to be the southeastern part of the United States, five of the nine forms being found only in that region; it is there we find the greatest diversity in the genus and it is only in that general region that we find all four

groups of the same. The New England States form part of the range of three species, the Middle Atlantic States and the mountainous region of the southern states of four species, while but two species are found in the northern Mississippi Valley and but one reaches Arkansas. The genus is thus seen to be a group of essentially austral character.

Of the species of Group A, *testaceus* is a more northern adaptation of the austral *pachymerus* type, while *davisi* is the more nearly boreal of any of the forms of the genus, being represented in the southern Appalachians by the allied *monticola*. The single species of Group B (*americanus*) occupies an area in general more or less elevated and somewhat to the northward of the range of the single species of Group C (*gibbosus*), which latter extends southward to central Florida. Of Group D all are Coastal Plain or Floridian, *dorsalis* is coastal and north Floridian, occurring with *calcaratus*, which latter is also north Floridian and Coastal, replaced in central and south Florida by *glaber*.

History.—In 1838, Burmeister [3] described two species of this genus from South Carolina, calling them *Decticus pachymerus* and *dorsalis*. In 1859, Saussure [4] described a new genus and species from Tennessee, as *Orchesticus americanus*, this clearly being a member of the present genus. The generic name *Orchesticus* has been generally used for a quite different genus. Scudder, in 1862,[5] used the Burmeisterian names for two species found in the northeastern states, which he referred to the Old World genus *Thyreonotus*. In 1869, Walker [6] described a species from Massachusetts as *Decticus derogatus*. Brunner, in 1893,[7] described a genus *Engoniaspis* in a key, basing it on an undescribed species from Missouri. A sketch of this species, later supplied to Caudell,[8] showed it to be a member of the present genus. In 1894, Scudder [9] published a brief key to the species of the genus, which he there diagnosed and named *Atlanticus*, also

[3] Handb. der Entom., ii, abth. ii, pt. 1, pp. 712 to 713, (1838).
[4] Revue et Magasin de Zoologie, 2e ser., xi, p. 201, (1859).
[5] Boston Journ. Nat. Hist., vii, p. 453, (1862).
[6] Catal. Dermapt. Saltat. Brit. Mus., ii, p. 260, (1869).
[7] Ann. Mus. Civ. Stor. Nat. Genova, xxxiii, p. 185, (1893).
[8] Proc. U. S. Nat. Mus., xxxii, p. 325, fig. 29, (1907).
[9] Canad. Entom., xxvi, p. 180, (1894).

describing *A. gibbosus* from the southern states. In the same paper Scudder placed the genus *Engoniaspis* in his key to the genera of the North American Decticinae[10] on the basis of an unnamed species, which he presumed was from Missouri. In 1900, the same author[11] described this previously unnamed specimen as *Engoniaspis testaceus*. Rehn, in 1900, finding the name *Orchesticus* Saussure, which had been used in connection with a quite different genus, preoccupied by *Orchesticus* Cabanis in birds, replaced it by a new name *Stipator*,[12] this being due to his use of the older name in the erroneous sense of all authors subsequent to Saussure. Caudell, in 1907, published a revision of the North American species of this subfamily and showed that the genus *Engoniaspis* is a synonym of the present genus,[13] the supposed differential characters given by Scudder not being of generic rank. In 1912, Rehn and Hebard[14] described *Atlanticus glaber* from southern Florida.

Nomenclature.—The identity of Burmeister's two species has been universally allowed to rest on the basis of Scudder's 1862 placing. However, he had no material from their original locality for study, and the species he examined are different from those found in the region from which Burmeister's material probably came. For discussion of this, see under *A. pachymerus*. We have before us two species from that region which answer the descriptions of Burmeister. Saussure's *Orchesticus* and *O. americanus* have been erroneously used by all authors for the genus and one of the species of a western genus allied to *Atlanticus*, to which, however, as we have shown beyond, the name has no application. On account of the preoccupation of *Orchesticus* by *Orchesticus* Cabanis in birds, Rehn, in 1900, unfortunately in ignorance of the real application of the name, and following previous authors in its usage, renamed the genus *Stipator*. This peculiar situation, when corrected by making *Stipator* a pure synonym of *Atlanticus*, makes necessary a new name for the *Orchesticus* of Scudder, not of Saussure, for which we here

[10] Canad. Entom., xxvi, pp. 177 and 179.
[11] Proc. Davenp. Acad. Nat. Sci., viii, p. 96, (1900).
[12] Trans. Amer. Entom. Soc., xxvii, p. 90, (1900).
[13] Proc. U. S. Nat. Mus., xxxi, pp. 321, 324 and 325, (1907).
[14] Proc. Acad. Nat. Sci. Phila., 1912, p. 269, (1912).

propose **Pediodectes**[15] with *Pediodectes grandis* (Rehn) [*Stipator grandis* Rehn] as its type. Saussure's *americanus* is really the species for which Scudder used Burmeister's name *dorsalis*. The name *Engoniaspis* Brunner, 1893, and Scudder, 1894, having no described species cannot be considered, the 1900 description of Scudder being the first of complete form, from which consequently *testaceus*, the first included species, must be taken as the type. As we have shown under *testaceus*, that name should apply to the species for which Scudder used the Burmeisterian name *pachymerus*, *testaceus* having been based on a damaged female, which, however, Scudder considered of uncertain sex. Walker's *derogatus* we now know to have been based on the species called *dorsalis* by Scudder, not of Burmeister, and *americanus* by Saussure. Caudell, in 1907, had *pachymerus*, *testaceus* and *davisi* confused as a single species, the evident differences being ascribed by him to individual variation. The same author referred to the present genus immature specimens belonging to other genera from Arizona and California.

Material Examined.—We here record 419 specimens of the genus, these comprising practically all the series in the collections of the Academy of Natural Sciences of Philadelphia, of the junior author, the United States National Museum, the Museum of Comparative Zoology, of Prof. A. P. Morse of Wellesley, Massachusetts, of Mr. W. T. Davis of New Brighton, New York, the Pennsylvania State Department of Zoology, the Georgia State Collection, the North Carolina Department of Agriculture and Cornell University. Certain specimens belonging to the American Museum of Natural History have also been examined. To the gentlemen above named and the authorities in charge of the collections of the above mentioned institutions and departments we wish to tender our thanks for the assistance so ungrudgingly given to our work. Of the total number of specimens examined 211 were collected by the authors, these representing all but one of the forms.

The types of the following have been examined by us:

Engoniaspis testaceus Scudder

Atlanticus davisi new species

Atlanticus monticola Davis

[15] From πεδίον *plain* (in allusion to its habitat) and δήκτης *a biter*.

Atlanticus glaber Rehn and Hebard

Atlanticus calcaratus new species

In addition, Mr. Caudell has kindly furnished us with information on the type of Walker's *Decticus derogatus* (= *americanus*), which is in the British Museum.

Key to Species

This key is admittedly artificial in a number of features, as it has been found almost impossible to construct a key to the forms along natural or presumably phylogenetic lines. The use of the plate figures in connection with the key is strongly recommended.

A. Medio-internal spur of caudal tibiae more than twice as long as the ventro-internal spur. (Disk of pronotum narrow, subequal in width. Prosternum unspined.) **calcaratus** new species

AA. Medio-internal spur of caudal tibiae distinctly less than twice or not more than twice as long as the ventro-internal spur.

B. Pronotal disk in both sexes very narrow, subequal, the greatest width contained nearly or quite two and one-half times in the greatest length of the disk, with lateral angles subparallel. **glaber** Rehn and Hebard

BB. Pronotal disk in both sexes more or less distinctly expanding caudad, the greatest (caudal) width almost never contained twice in the greatest length of the disk, the lateral angles more or less distinctly diverging caudad.

C. Lateral angles of pronotal disk distinct but rounded in section and never sharp and carinate. Tegmina of male almost or quite completely covered by the pronotum.

D. Size medium. Pronotum with the width of the disk at cephalic fourth not less than that at cephalic margin; caudal margin of disk arcuato-truncate. Caudal femora not greatly inflated proximad. Cercus of male short, robust, with short tooth. **dorsalis** (Burmeister)

DD. Size very large (largest in the genus). Pronotum with the width of the disk at cephalic fourth appreciably less than that at cephalic margin; caudal margin of disk strongly arcuate. Caudal femora greatly inflated proximad. Cercus of male elongate, corniform, with elongate equally corniform tooth. **gibbosus** Scudder

CC. Lateral angles of pronotal disk very distinct, strongly angulate in section, sharp and frequently carinate. Tegmina of male never completely covered by the pronotum.

D. Cercus of male relatively elongate. Subgenital plate of male narrowly and deeply fissate. Subgenital plate of female deeply divided and lateral portions of same sublanceolate. (Ovipositor straight or faintly decurved, apex ventral.) **americanus** (Saussure)

DD. Cercus of male relatively short, robust. Subgenital plate of male angularly emarginate to various degrees, never fissate. Subgenital plate of female V- or U-emarginate, lateral portions of same never sublanceolate.

E. Tegmina of male projecting caudad of the pronotal disk a distance considerably exceeding half the pronotal length. Pronotum of male proportionately very large. Subgenital plate of female narrowly V-emarginate and with lateral portions of the plate broadly rounded distad. (Caudal femora robust and quite short; ovipositor straight, apex ventral. **testaceus** (Scudder)

EE. Tegmina of male projecting caudad of the pronotal disk a distance distinctly less than one-half the pronotal length. Pronotum of male relatively shorter or narrower. Subgenital plate of female when narrowly V-emarginate always having the lateral portions of the plate at least subangulate distad.

F. Caudal femora more elongate and slender. Pronotum in general more elongate, the disk relatively more slender, the lateral angles less divergent caudad. Tegmina of male slightly produced distad. (Ovipositor straight, with apex ventral.) **pachymerus** (Burmeister)

FF. Caudal femora less elongate, more robust. Pronotum more abbreviate, more robust, the disk relatively broader, the lateral angles strongly divergent caudad. Tegmina of male broadly rounded distad.

G. Subgenital plate of female U-emarginate. Ovipositor distinctly arcuate. Lateral angles of pronotal disk strongly sigmoid. Eyes more prominent. **monticola** Davis

GG. Subgenital plate of female V-emarginate. Ovipositor straight, very faintly arcuate or faintly decurved. Lateral angles of pronotal disk less sigmoid and more regularly (*i.e.* directly) diverging caudad. Eyes as usual in the genus. **davisi** new species

Atlanticus testaceus (Scudder) (Pl. VI, figs. 2, 3, and 20; pl. VII, figs. 1, 10 and 19; pl. VIII, figs. 1 and 11.)

1862. *T[hyreonotus] pachymerus* Scudder (not *Decticus pachymerus* Burmeister, 1838), Boston Journ. Nat. Hist., vii, p. 453. [Connecticut; Mammoth Cave, Kentucky.]

1893. *Thyreonotus pachymerus* Davis (not *Decticus pachymerus* Burmeister, 1838), Canad. Entom., xxv, p. 108. [Staten Island, New York.]

1894. [*Atlanticus*] *pachymerus* Scudder (not *Decticus pachymerus* Burmeister, 1838), Canad. Entom., xxvi, pp. 179, 180, 183. (In key to species of the genus.)

1894. *Atlanticus pachymerus* Beutenmüller (not *Decticus pachymerus* Burmeister, 1838), Bull. Amer. Mus. Nat. Hist., vi, p. 285, pl. VII, fig. 7. [Vicinity of New York City.]

1898. *Atlanticus pachymerus* Lugger (not *Decticus pachymerus* Burmeister, 1838), Bull. 55, Minn. Agr. Exp. Sta., p. 335, fig. 60. [Minnesota.]

1900. *Engoniaspis testacea* Scudder, Proc. Davenp. Acad. Nat. Sci., viii, p. 97. [Missouri?]

1903. *Atlanticus pachymerus* Blatchley (not *Decticus pachymerus* Burmeister, 1838), Orth. of Indiana, p. 393, fig. 98. [Lake, Marshall, Marion, Putnam, Vigo and Crawford Counties, Indiana.]

1907. *Atlanticus pachymerus* Caudell, Proc. U. S. Nat. Mus., xxxii, p. 323, fig. 28. (In part.)

1911. *A[tlanticus] pachymerus* Walden (not *Decticus pachymerus* Burmeister, 1838), Bull. 16, Conn. State Geol. and Nat. Hist. Surv., p. 141, pl. XI, fig. 2. [Scotland, Connecticut.]

The name *pachymerus*, which has been applied to this species by authors, has no relationship to the present form, but should be used instead for a species found in the southeastern states. For a discussion of this matter, see under the treatment of *pachymerus*. The next name available for this species is Scudder's *Engoniaspis testacea*, described from a specimen supposed to be from Missouri. The type of this species was in an imperfect condition when described and to-day it is minus the apex and greater portion of the abdomen, the cephalic and median limbs and neither caudal limb is fully complete. We have been able to compare it with the present series of the species of the genus and it is evident, from a careful study of the proportions of the pronotal disk and of the remaining limbs, that it represents this species and not the allied *davisi*. The figure which has been given of it by Caudell, while exact, is a lateral view and does not bring out such features of the dorsum of the pronotum as would enable one to place it properly.

The species is readily recognized in both sexes by the short caudal femora, in the male sex by the relatively produced tegmina, which extend distad of the striking transverse depression outlining the stridulating field a distance equal to nearly or quite one-half the median length of the pronotal disk, and in the female sex by the relatively short and robust ovipositor, the apex of which is ventral in position.

Type.— ♀ ; Missouri? (Riley Collection.) [No. 5734, United States National Museum.]

Morphological Notes.—The principal features of variation found in this species can best be treated one by one. The pronotum in the male sex always has the greatest caudal width of the disk equalling 60 to 72 per cent of the greatest length of the same, while the caudal margin of the disk varies in form from arcuate, to arcuate with an appreciable median flattening; the cephalic margin of the disk varies in both sexes from truncate to

very shallowly obtuse-angulate emarginate. The greatest width of the pronotal disk in the female equals 63 to 73 per cent the length of the same, while the caudal margin is always subtruncate, at least so mesad. The least width of the pronotal disk, *i.e.* at the cephalic fourth, is, in both sexes, equal to from $\frac{9}{16}$ to $\frac{5}{8}$ of the greatest (caudal) width of the same. The tegmina of the male vary but little in length, as shown by the measurements; the apices of the tegmina are well rounded. In the female the tegmina reach almost or quite to the caudal margin of the pronotal disk, but are always covered by the same. The abdomen is moderately (♂) or quite faintly (♀) tricarinate.

The disto-dorsal abdominal segment of the male is generally angulate-emarginate, the degree of same varying and occasionally the angle is rounded; supra-anal plate of the male is in general form trigonal, occasionally with the angle somewhat rounded, a medio-longitudinal sulcus present on the same and more distinctly indicated proximad. The cerci of the male vary slightly in robustness, particularly in the distal portion, the tooth also showing some slight variation in its exact position and in the sharpness and falcation of the same. The subgenital plate of the male has the distal margin varying from subtruncate to rectangulate-emarginate, generally somewhat rotundate-angulate, the styles varying appreciably in length.

The supra-anal plate of the female varies somewhat in the degree of angulation, the sulcus indicated as in the male. The ovipositor is fairly uniform in length, the variation in this, as illustrated by the measurements, being individual. One representative from Moline, Illinois, has the longest ovipositor (23 mm.), next to which stand two females from Guthrieville and Malvern, Pennsylvania (22 mm.). In the depth of the ovipositor there is some variation but not sufficient to change the general form of the same. The subgenital plate of the female has the form constant and shows no noteworthy variation from that figured.

The caudal femora in both sexes of the present species are quite short, in fact relatively shorter than in any other form of the genus. While there is some variation in the length, aside from that which is proportional, it is of a negligible quantity.

Color Notes.—In general color there is some variation in the depth of the same, but the most noteworthy features of this character found in both sexes are the amount of grayish suffusion on the dorsal surface of the head and pronotum, the strength and extent of the shining black area caudad on the lateral lobes of the pronotum and to a lesser degree the width and extent of the pale caudal area on the same lobes. In the male the tegmina vary considerably in the tone of the ochraceous of the disto-dorsal section and humeral angle of the same, occasionally this being even dark rufous, while the lateral section of the proximal abdominal segments and a dorsal area of the pleura are variable in the presence or absence, and depth when present, of shining black.

Geographic Variation.—There appears to be no geographic variation except that the males show an increase southward in the general size of the pronotum. This is, of course, to a degree correlated with variation in general size, but only to a certain extent. The females show no appreciable geographic variation.

Measurements (in millimeters)

♂	Length of body[16]	Greatest length of pronotum	Greatest width of pronotal disk	Lateral length of tegmen	Length of tegmen distad of transverse depression	Length of caudal femur	Length of ovipositor
Deep Pond, New York	18	9.5	6.5	7.8	4	14.8	....
Newfoundland, New Jersey	19.5	9.4	6.3	8.5	4.6	16.2	....
Guthrieville, Pennsylvania.	23.4	10.8	7	8.5	5	15.6	....
Guthrieville, Pennsylvania.	21.2	9.8	6.5	8	4.5	14.6	....
Plummer's Island, Maryland	20.9	10.1	7.2	7.5	4.1	16	....
Plummer's Island, Maryland	20	11.2	7.8	7.8	5	17	....
Glen Echo, Maryland	24.3	10	7.1	7	4	16	....
Gun Lake, Michigan	19.5	9	6	8	4.9	15.4	....
Vigo County, Indiana	19	10	6.8	7.8	4.5	16.8	....
Kentucky	19.5	10.4	7.5	9	5	17	....
Moline, Illinois	20.4	9.6	7	8.2	4.9	16.5	....

[16] Body length is the most unreliable of any of the measurements here given, depending as it does on the degree of compression or extension of the abdomen; a considerable factor when shrivelling or stuffing are taken into consideration. However, as this measurement is the one most generally given we are including it here, as elsewhere, as a general index to the bulk of the insect.

Measurements (in millimeters)—Continued

♀	Length of body	Greatest length of pronotum	Greatest width of pronotal disk	Lateral length of tegmen	Length of tegmen distad of transverse depression	Length of caudal femur	Length of ovipositor
Marion, Massachusetts....	23.5	9.2	6.2	....	....	16.6	19
Marion, Massachusetts....	20.6	9.2	6.2	....	....	16.3	19.2
Wading River, New York..	19.2	9.5	6.1	....	....	17.8	19.6
Jamesburg, New Jersey ...	19.2	9.2	6.4	....	....	17.2	19
Greeley, Pennsylvania	18.6	8.8	6.1	....	....	17	19
Danville, Pennsylvania ...	20.3	10.4	7.3	....	....	18.2	21.2
Malvern, Pennsylvania....	19.2	10.2	6.6	....	....	18.7	22
Guthrieville, Pennsylvania.	23.8	9.2	6.7	....	....	17.3	20.8
Guthrieville, Pennsylvania. Average and extremes of five specimens	24.6 (22–26.8)	9.7 (9.4–10)	6.7 (6.3–7)	....	....	17.1 (17–17.2)	20.4 (19.2–22)
Plummer's Island, Maryland	21.5	9.4	6.7	....	....	17.1	19
Plummer's Island, Maryland	21	9.4	6.5	....	....	17.2	19.4
Cabin John Run, Maryland	23.5	10	6.9	....	....	18.9	20.5
Washington, D. C.	20.5	9.3	6.5	....	....	17.8	17.6
Washington, D. C.	20.6	9.8	6.5	....	....	18.7	18.9
Arlington, Virginia.....	22	9.5	6.5	....	....	16.2	19.8
Arlington, Virginia	23.7	9.7	6.2	....	....	17.2	19.6
Porcupine Mountains, Michigan.....	25.5	10	7	....	....	19	18.8
Moline, Illinois.....	23.2	9.5	6.6	....	....	18.4	23
Peoria, Illinois	19.5	9.2	6.5	....	....	18.8	21
Locality ? (Missouri ?) *Type*.....		9.2	6.3	....	....	18.4	....

Biological Notes.—The earliest date we have for the occurrence of the species in an adult condition is June 6, when Blatchley secured it in Vigo County, Indiana. The earliest date in the series now before us is June 14 to 15, Bee Spring, Kentucky, while we find mature specimens from northern New Jersey (Ramsey) taken as early as June 23. The latest record we have is from Harrisburg, Pennsylvania, October 15. From information given by Davis, on the basis of the life of a male kept in captivity,

the longevity of individuals of the species is seen to be considerable, the specimen in question living from June 26 to at least the sixth of September. The account given by Davis of the actions of this specimen[17] contains the best information we have of the individual habits of any species of this genus.

Distribution.—The range of this species extends from eastern Massachusetts (Brookline and Marion), southern Ontario (Arner), northwestern Michigan (Porcupine Mountains) and Minnesota, south to northern Virginia (Arlington) east of the Appalachians, and to central Kentucky (Mammoth Cave, Bee Spring and Tyrone), southern Indiana (Crawford County) and central Illinois (Peoria) west of the Appalachians. We have not examined it from the west of the Mississippi River and we have no positive previous record from that area except the general "Minnesota" given by Lugger and the doubtful Missouri one of the type. The figure given by Lugger is clearly this species. Bruner has recorded the species as rare in "Eastern Nebraska," but no material of the genus from that state was contained in his collection. The occurrence of this species there, while possible, appears doubtful and requires further confirmation. In New Jersey, Pennsylvania, Maryland and Virginia the species occurs but little to the eastward of the fall-line.

Specimens Examined: 70; 45♂, 25♀.

Marion, Massachusetts, VIII, 30, 1905, (H.), 2 ♀.

Croton, New York, (W. T. Davis), 1 ♂, [Davis Cln.]

Deep Pond, Wading River, Long Island, New York, VII, 26, 1914, (W. T. Davis), 2 ♂, [Davis Cln.].

Wading River, Long Island, New York, VII, 25, 1914, (W. T. Davis), 1 ♀, [Davis Cln.].

Staten Island, New York, VI, 26, 1892, (W. T. Davis), 1 ♂, (Davis Cln.].

Ramsey, New Jersey, VI, 23 and 25, 1912, (W. T. Davis), 2 ♂, [Davis Cln.].

Newfoundland, New Jersey, VII, 3, 1912, (W. T. Davis), 1 ♂, [Davis Cln.].

Bear Swamp, Ramapo Mountains, New Jersey, VI, 24, 1912, (W. T. Davis), 1 ♀, [Davis Cln.].

Jamesburg, New Jersey, VII, 20, 1912, (W. T. Davis; at sugar), 1 ♀, [Davis Cln.].

Greeley, Pike County, Pennsylvania, 2300 feet elevation, (Einer Olsen), 1 ♀, [Davis Cln.].

Danville, Pennsylvania, IX, 12, 1 ♀, [Pa. St. Dept. Zool.].

Wetzel's Swamp, Harrisburg, Pennsylvania, X, 15, 1 ♂, [Pa. St. Dept. Zool.].

Stoverdale, Pennsylvania, VII, 16, 1915, (E. Daecke), 1 ♀, [Daecke Cln.].

[17] Canad. Entom., xxv, p. 108, (1893).

Serpentine Ridge south of Malvern, Pennsylvania, VI, 26, 1912, (Bayard Long), 1 ♀, [A. N. S. P.].

Guthrieville, Pennsylvania, VII, II, 1911, (R. & H.; in blackberry tangle on edge of deciduous woods on hilltop), 4 ♂, 25 ♀.

Castle Rock, Pennsylvania, VI, 30, 1907, (E. Daecke), 1 ♂, [Hebard Cln.].

Pattonville, Pennsylvania, VII, 31, 1871, (Shaler), 1 ♀, [M. C. Z.].

Plummer's Island, Maryland, VIII, 11, 17 and 25, 1907, (A. K. Fisher), 2 ♂, 2 ♀; VIII, 27, 1909 and IX, 2, (A. N. Caudell), 2 ♂; VIII, 5, 1914, (Shannon; in trap), 1 ♀, [all in U. S. N. M.].

Cabin John Run, Maryland, VI, 20, 1911, (W. T. Davis), 1 ♀, [Davis Cln.].

Glen Echo, Maryland, VII, 10, 1914, (A. N. Caudell), 1 ♂, [U. S. N. M.].

Washington, District of Columbia, VII, 2, 1911, (W. T. Davis) 1 ♂, 1 ♀, [Davis Cln.].

Arlington, Virginia, VII, 9, 1914, (H.; at night), 2 ♀.

Porcupine Mountains, Michigan, VII, 13 to VIII, 12, 1904, (C. C. Adams; on east slopes), 1 ♀, [Morse Cln.].

Gun Lake, Michigan, VI, 13 to 26, 1912, (M. A. Carriker Jr.), 1 ♂, [Hebard Cln.].

Vigo County, Indiana, (W. S. Blatchley), 1 ♂, [Hebard Cln.].

Kentucky, (F. G. Sanborn), 1 ♂, [M. C. Z.].

Bee Spring, Kentucky, VI, 14 to 15, 1874, (F. G. Sanborn), 1 ♀, [M. C. Z.].

Moline, Illinois, (McNeill), 1 ♂, 1 ♀, [Hebard Cln.].

Peoria, Illinois, VII, 1875, 1 ♀, [M. C. Z.].

Missouri ?, (Riley Collection), 1 ♀, *type*, (U. S. N. M.].

Atlanticus pachymerus (Burmeister) (Pl. VI, figs. 4, 5, and 6; pl. VII, figs. 1, 10 and 20; pl. VIII, figs. 1 and 12.).

1838. *D[ecticus] pachymerus* Burmeister, Handb. der Entom., ii, abth. ii, pt. i, p. 712. [South Carolina[18].]

1842. *L[ocusta] (Ephippigera) pachymera* De Haan, Verhandl. Natuurl. Geschied., Bidjr. Kenn. Orth., p. 178. (Bare combination.)

1907. *Atlanticus pachymerus* Caudell, Proc. U. S. Nat. Mus., xxxii, p. 323. (Part.) [North Carolina.]

1911. *Atlanticus dorsalis* Sherman and Brimley, Entom. News, xxii, p. 390. (Part.) [Southern Pines, North Carolina.]

1911. *Atlanticus pachymerus* Sherman and Brimley, Ibid., p. 390.

[18] There is a strong probability that the original specimens of this species were collected by Zimmermann, who was working in South Carolina at that time and regularly sending material to Europe. As we have already shown (Trans. Amer. Entom. Soc., xli, p. 34, (1915)), until 1838 Zimmermann's work in the state was probably all done in the vicinity of Georgetown, which is doubtless the type locality of the present species. In the absence, however, of a positive statement by Burmeister as to the collector we would hardly be justified in positively fixing this matter. The specimens were, according to Burmeister, in Germar's collection, and the collector's name probably had not been preserved. In the case of material belonging to himself and collected by Zimmermann, Burmeister carefully credited it to the collector.

This interesting species, which previously never has been properly differentiated from the more northern *testaceus*, is a moderately close relative of the latter species, but is so distinct in general appearance, particularly in the male sex, that no difficulty need be encountered in distinguishing the two forms. In the female sex the two species might be mistaken in a superficial examination, but the distinctly longer caudal femora of the present form will separate them immediately on comparison of material.

The important features of difference from the generally well known *testaceus* are as follows: In both sexes, the caudal femora are at least twice (♂) or more than twice (♀) as long as the pronotal disk; the cephalic and median limbs are relatively longer; the greatest caudal width of the pronotal disk is equal to 54 to 66 per cent of the greatest length of the same; the prosternal spines are more aciculate and elongate and the mesosternal lobes are more acute. In the male sex the pronotum is less expanded caudad, the divergence of the lateral carinae being less pronounced; the tegmina are well produced, the portion distad of the transverse impression distad of the stridulating field distinctly shorter than in *testaceus;* the cerci are more slender and more acuminate, the apex more produced, the tooth more nearly median than in *testaceus;* subgenital plate of the male with the distal margin rectangulate-emarginate to acutely subfissate, styles slender and relatively elongate. In the female sex the abdomen has the lateral carinae distinctly and the median carina slightly more pronounced; the ovipositor, while of approximately the same length as in *testaceus*, is relatively much shorter, being considerably less than the length of the caudal femur, the form of the ovipositor similar to that of *testaceus* but hardly as deep; the subgenital plate is more deeply divided and the lateral portions rotundato-rectangulate.

Synonymy.—We are able to place Burmeister's name on this species by a process of elimination. It is very briefly characterized, there being nothing diagnostic in the several lines of general description, but the three words describing the male, "elytris liberis fornicatus," clearly refer to this species, *testaceus* or *davisi*; of these only the present form occurs near the coastal region of South Carolina, from which, as already shown, the original material of *pachymerus* probably came. The char-

acters given for the female, "elytris nullis; vagina recta, abdomine longior," are only sufficient to separate the species from *monticola*. The length of the body and of the caudal femora given in the original description, without indication of sex, while less than any found in the material before us, do not invalidate at all the claim of this species to Burmeister's name. The body length given could easily be accounted for by the abdomen being shrunken, a condition which is quite capable of making a change of as much as five millimeters, while geographic or individual size variation could easily cause the discrepancy seen in the femoral length. In the five females examined by us we find a difference of 2.7 mm. in the femoral length, while in the related *testaceus* our series shows a variation of 2.4 mm. in both sexes. It seems evident to us that Burmeister either measured a very small specimen or in giving the caudal femoral length merely approximated the actual proportions. There is a possibility of error in the figures, as he gave them as "Long. corp. 9″, femur. post. 8″.", using the inch sign instead of that for lines, but as this is evidently an error we have used them as if clearly expressed in lines. The femoral length may show undue difference from our measurements on account of difference in method of taking the same; our length of this portion is always taken along the ventral line, while one taken along the dorsal line would give a length at least one-half millimeter less. As shown by an examination of the information given under *testaceus*, that species has not been definitely recorded from nearer South Carolina than Arlington, Virginia, and central Kentucky. There is no evidence that *testaceus* could even be considered a northern form extending into the mountainous region of South Carolina, as we have no information on its occurrence in any of the really mountainous areas of its range. In Pennsylvania, for example, it is replaced in the mountains proper by the short-tegmined *davisi*.

Morphological Notes.—The disk of the pronotum shows the usual variation in the greatest (caudal) width of the same, this being more appreciable in the males before us than in the females. A glance at the measurements will show the extent of this variation. The male subgenital plate, as above mentioned, varies in the degree of angulation of the caudal margin. The cerci of the male vary somewhat in robustness and in the degree of the

attenuation, as well as in straightness or slight curvature of the distal portion. The ovipositor is quite constant in form.

Color Notes.—The dorsum of the body shows a pronounced ochraceous suffusion in some males, this occasionally more decided on the pronotum, while the lateral lobes have their dorsum occasionally quite solid (except for the usual pale humeral border) shining black. The latter feature varies in depth and is most marked in the male, and when decided is accompanied by a corresponding blackening of the dorsal section of the pleura. One female is very distinctive in having the entire dorsum, from the fastigium to the apex of the abdomen, uniform bay, this sharply delimited laterad by the lateral carinae of the pronotum and abdomen.

Measurements (in millimeters)

	Length of body	Greatest length of pronotum	Greatest (caudal) width of pronotal disk	Lateral length of tegmen	Length of tegmen distad of transverse depression	Length of caudal femur	Length of ovipositor
Sex ?							
South Carolina (ex Burmeister)	18.7	....	....	....	....	16.6	....
♂							
Goldsboro, North Carolina	23.2	9.5	5.8	5.4	3	19.8	....
Goldsboro, North Carolina	25.7	9.9	5.9	5.8	3.4	20	....
Goldsboro, North Carolina	23.5	9.9	6.1	5.8	3.1	20.3	....
Southern Pines, North Carolina	25.2	11.4	7	7.6	3.8	22.5	....
Rich Mountain, Arkansas	22	10.2	6.6	6.5	3	23.4	....
Mena, Arkansas	26.7	10.6	6.7	6.5	2.9	24.2	....
Mena, Arkansas	25	10.6	6.6	5.6	2.7	23	....
♀							
Greensboro, North Carolina	20	10	6.5	....	....	21	21
Raleigh, North Carolina	21	9.1	6	....	....	....	21
Goldsboro, North Carolina	25	10.2	6.1	....	....	22.2	19.4
Lake Ellis, North Carolina	21	10	5.7	....	....	22.3	18
Lake Ellis, North Carolina	27.3[19]	10.5	6	....	....	23.7	19.7
Southern Pines, North Carolina	25.2	10.2	6.3	....	....	23.7	21
Southern Pines, North Carolina	28.2	10.6	6.4	....	....	24	23
Magazine Mountain, Arkansas	28.2	10.6	6.2	....	....	24.2	24.2
Mena, Arkansas	25	9.5	6	....	....	23	21.6

[19] Abdomen greatly distended.

It will be seen from these measurements that considerable individual variation is present in the general size and relative, as well as actual, length of the pronotum compared with the length of the caudal femur. The ovipositor is also seen to vary in length individually, but this apparently is also to an extent geographic.

Geographic Variation.—The general size shows no geographic correlation but the length of the caudal femur, actual as well as relative, shows an increase westward; this may be, in a measure at least, environmental, as the series is too small to make satisfactory deductions of this character. The same is true of the length of the ovipositor. The Arkansas males and the one from Southern Pines, North Carolina, have the subgenital plate more deeply and narrowly divided than the specimens from Goldsboro, which may be geographic but more probably is environmental or individual in explanation.

Biological Notes.—From the material before us it is apparent that the species reaches maturity early in June, certainly by June 19, our earliest exact date; the latest date in our small representation is August 29. In late May the species is in at least one instar preceding maturity. The only datum we have on the habits of the species is that, at Goldsboro, North Carolina, we found it among fallen leaves of deciduous trees in a rather open forest composed chiefly of short-leaf pine. In this situation the species was not common.

Distribution.—The Coastal Plain region and adjacent portions of the Piedmont area of North and South Carolina and the Ozark Mountain region of Arkansas, the distribution doubtless being continuous, although we have seen no specimens from between the two regions. The most northern localities known for the species are Greensboro and Raleigh, North Carolina, the former being the most elevated point in the eastern states at which it has been taken, while it occurs at Lake Ellis near sea-level in the same state. We have no exact record of the occurrence of the species in South Carolina. In Arkansas it has been taken as high as 2600 feet on the summit of Rich Mountain.

Specimens Examined: 18; 7 ♂, 9 ♀, 1 juv. ♂, 1 juv. ♀.
Greensboro, North Carolina, VI, (F. C. Pratt), 1 ♀, [U. S. N. M.].

Raleigh, North Carolina, VII, 10, 1902, (F. Sherman, Jr.), 1 ♀, [N. C. Dept. Agr.].

Goldsboro, North Carolina, VII, 25, 1913, (R. & H.; among leaves in forest composed chiefly of short-leaf pine), 3 ♂, 1 ♀.

Lake Ellis, (Havelock), North Carolina, late May, 1907, (L. M. Smith), 1 juv. ♀, [N. C. Dept. Agr.]; VI, 19 to 24, 1905, (F. Sherman), 2 ♀, [U. S. N. M. and N. C. Dept. Agr.].

Southern Pines, North Carolina, V, 17, 1915, (A. H. Manee), 1 juv. ♂, [Hebard Cln.]; early June, 1908, (A. H. Manee), 1 ♂, [N. C. Dept. Agr.]; VII, 8, 1904, (F. Sherman Jr.), 1 ♀, [U. S. N. M.]; VII, 2, 1912, (W.T. Davis), 1 ♀, [Davis Cln.].

Magazine Mountain, Arkansas, 2000 feet elev., VIII, 29, 1905, (A. P. Morse), 1 ♀, [Morse Cln.].

Rich Mountain, Summit, Arkansas, 2600 feet, VIII, 1, 1905, (A. P. Morse), 1 ♂, [Morse Cln.].

Mena, Arkansas, VII, 30, 1905, (A. P. Morse), 2 ♂, 1 ♀, [Morse Cln.].

Atlanticus davisi new species (Pl. VI, figs. 7, 8, and 9; pl. VII, figs. 3, 12 and 21; pl. VIII, figs. 3, 4, 5, and 13.)

1903. *Atlanticus dorsalis* Blatchley (not *Decticus dorsalis* Burmeister, 1838), Orth. of Indiana, p. 395. [Putnam, Vigo, Knox and Crawford Counties, Indiana.]

1907. *Atlanticus pachymerus* Caudell, Proc. U. S. Nat. Mus. xxxii, p. 323, fig. 27. (Part.) [Virginia.]

1911. *Atlanticus pachymerus* Sherman and Brimley, Entom. News, xxii, p. 390. (Part.)

This interesting form has had a varied nomenclatural career, as the above more important references show. Caudell did not distinguish it from true *pachymerus* and *testaceus*, calling all *pachymerus* and ascribing the evident differences to individual variation. Blatchley distinguished it from "*pachymerus*" (i. e. *testaceus*), but erred in calling it "*dorsalis*" (i. e. *americanus*). We have examined practically all the material seen by Caudell and therefore can speak definitely regarding the reference. In regard to Blatchley's determination our study of the available material is sufficient to show the proper interpretation.

As this distinct and easily recognized type requires a name, we take great pleasure in dedicating it to our friend, Mr. William T. Davis of New Brighton, Staten Island, New York, to whose assistance in the way of loans of specimens and suggestions from his large store of field experience we owe so much.

Type.—♂; Orange, Orange County, Virginia. July 21, 1913.

(Rehn and Hebard; in dead leaves and scattered green undergrowth in chestnut forest.) [Hebard Collection, Type no. 399.]

This species can be readily separated from the allied *testaceus* and *pachymerus* by the following characters. From both the older species the male can be readily distinguished by the shorter pronotum and the much reduced area of the disto-dorsal section of the tegmina. From *testaceus* the male of *davisi* is also readily distinguishable by the more slender cerci, while from the same sex of *pachymerus* it is also separated by the slightly more pronounced humeral sinus, the shorter and more robust caudal femora, narrower pronotal disk and less attenuate cerci. The female of *davisi* can be distinguished from that sex of both *testaceus* and *pachymerus* by the relatively shorter pronotum and more deeply divided subgenital plate, while from *testaceus* it can also be separated by the more angulate sections of the subgenital plate, the generally narrower ovipositor and the more sharply attenuate distal portion of the caudal femora, and lastly from that sex of *pachymerus* the female is separated in addition by the less elongate caudal limbs.

From *monticola* the present form can be distinguished by the somewhat less prominent eyes, by the less sigmoid lateral angles of the disk of the pronotum, which are straighter and more regularly divergent caudad in *davisi*, by the less decided contrast between the inflated proximal portion and the slender distal portion of the caudal femora, by the straight or at least straighter ovipositor and the narrower and V-emarginate subgenital plate of the female. More material may show the two forms *davisi* and *monticola* to be geographic races of the same species, the one of the southern Appalachians and the other of the northern portion of the same and adjacent systems and portions of the Piedmont region. As intermediates would be expected in the mountains of Virginia, we have made a careful examination of the few specimens available from that general region, but we have no positive evidence of intergradation, except that the female of *monticola* from Washington County, Virginia, has the subgenital plate less broadly U-emarginate, but it is without the least doubt *monticola*. The northern *davisi* is, apparently, in process of breaking up into at least two forms, not however,

sufficiently defined to recognize by name, and it is certain that *monticola* is a more ancient and more divergent, thoroughly established form, the geographic connecting intermediates of which may not exist to-day. At any rate it is the best policy to consider the two of specific rank until we have the proof of other relationship before us.

Description of Type.—Size rather small (for the genus); surface smooth but in general not polished. Head not elevated dorsad of the level of the pronotal disk, the fastigium moderately declivent, narrowly rounding into the line of the face which is slightly protuberant in the fastigial area, width of the fastigium slightly less than the width of one of the eyes; eyes in outline subovate with a quadrate tendency, their greatest dorso-ventral depth equal to about two-thirds the infra-ocular depth of the genae, when seen from the dorsum the eyes are moderately protuberant; antennae greatly surpassing the body length. Pronotum with the dorsum of the usual type, the narrowest point of the disk at about the cephalic third, the lateral carinae continuously indicated and regularly sigmoid, the greatest (caudal) width of the disk contained one and one-half times in the length of the same, cephalic margin of the disk very faintly obtuse-angulate emarginate, caudal margin flattened arcuate and well rounded laterad; lateral lobes with the greatest depth contained about one and four-fifth times in the greatest dorsal length of the same, cephalic margin of the lobes oblique-truncate, ventro-cephalic angle rounded obtuse, ventral margin subtruncate with the usual ventro-caudal trend, ventro-caudal angle well rounded, caudal margin oblique with a distinct and moderately marked, though shallow, humeral sinus. Tegmina very briefly surpassing the caudal margin of the pronotal disk, the proportion not more than one-half the caudal width of the disk, the distal portion well rounded, the whole strongly vaulted, the marginal field very narrow and subequal in width. Wings vestigial. Abdomen with indications of median and lateral carinae; disto-dorsal abdominal segment obtuse-angulate emarginate; supra-anal plate with the margins rectangulate, a distinct medio-longitudinal sulcus present; cerci rather short, of a substyliform type, the apex slightly blunted, internal tooth disto-median in position, short, subuncinate; subgenital plate with the distal margin rotundato-rectangulate emarginate, styles quite brief. Prosternal spines very short; mesosternal lobes slightly acute, the tips submammillate. Cephalic and median limbs rather short. Caudal femora subequal to twice the length of the pronotal disk, very considerably inflated proximad and relatively slender distad, ventro-external margin unarmed, ventro-internal margins showing from two to four spines; caudal tibiae with the principal internal distal spur not quite reaching the middle of the metatarsus.

Allotype.—♀; Same data as type. (Hebard Collection.)

Description of Allotype.—Differing from the description of the type in the following non-ambisexual characters. Tegmina minute, completely hidden under the pronotum. Supra-anal plate with form more rounded and the

sulcus proximal only; cerci short, terete; ovipositor very slightly longer than the caudal femora, straight, moderately robust, subequal in depth, not tapering (except on proximal third) and rather sharply narrowed to the apex which is ventro-median in position; subgenital plate sharply and deeply divided, the lateral portions of the plate with their tips regularly and sharply rectangulate. Caudal femora in length slightly more than twice that of the pronotal disk, ventro-internal margins of the caudal femora with single spines.

Paratypic Series.—We have indicated as paratypes a series of four males and seven females taken at the type locality and in company with the type and allotype.

Morphological Notes.—The variation in form found in this species is very considerable and has proved quite puzzling. One of the most striking features is the variation in the general form and proportions of the pronotal disk; this is very great, probably the greatest found in the genus, and the two extremes, both of which are present or closely approximated in each of the series from Arlington and Orange, Virginia, are so different that it requires careful examination to show they are not different species. In the male sex the proportion of greatest caudal width of disk to length of same varies from 67 to 74 per cent, and in the female sex the ratio is 62 to 71 per cent. The form of the disk is also influenced by the degree of constriction at the cephalic fourth, this and the general curve of the lateral carinae of the disk varying independent of the ratio of greatest breadth to length. The least width of the disk is contained from but little more than twice (♂; Broad Top Mountain, Penna.) to nearly thrice (♀; Arlington, Va.) in the greatest length of disk. The cephalic margin of the pronotal disk varies from shallowly angulate-emarginate to subtruncate, the latter condition unusual. The caudal margin of the pronotal disk is considerably arcuate in the male, varying in the female from similarly arcuate to truncato-arcuate. The humeral sinus of the lateral lobes is always well indicated. The tegmina of the male show no appreciable variation in length. The prosternal spines are always rather short, but vary greatly in length, and while occasionally quite aciculate are more frequently but brief dentiform projections, and more rarely mere subobsolete nodes. The mesosternal lobes are rectangulate with a subtuberculate angle. The disto-dorsal abdominal segment of the male shows an appreciable amount of variation in the degree of angulation of the median

emargination; the supra-anal plate of the same sex has its apical angle more acute and median sulcus more pronounced and more continuous in some specimens than in others. The male cerci vary somewhat in robustness and degree of attenuation of the distal third, the teeth being median or disto-median and, while short, strongly uncinate. The male sex has the subgenital plate with the margin varying from subtruncate to rectangulate emarginate, the majority of individuals having this portion obtusely emarginate; the styles vary from moderately long and slender to the very briefest knobs. The ovipositor of the female shows an amount of variation similar to that noticed in the form of the pronotal disk, this being chiefly in general form and not so much in length. In the northern specimens, *i. e.*, those from New York, Pennsylvania, Ohio, Indiana and Iowa, the ovipositor averages deeper, with the ventral margin straight or very faintly convex and the apex not distinctly ventral but approaching or reaching the median line of the ovipositor. In the majority of southern specimens, *i. e.* those from Virginia and Maryland, the ovipositor averages more slender, with the ventral margin straight or very weakly concave and the apex distinctly ventral in position. In the twelve females from Arlington and Orange, Virginia, we find two females which represent the more northern type and three others are intermediate. The Beltsville, Maryland female also represents an intermediate condition. The measurements given herein show that the variation in pronotal length is largely relative. The subgenital plate of the female is very deeply and narrowly V-emarginate and the lateral portions are always rectangulate to faintly obtuse-angulate, with the angle not or but very slightly rounded.

Color Notes.—The general color pattern of this form is that found in all the members of this species group. The general tone of the dorsal and lateral surfaces varies from tawny-olive through snuff brown and vinaceous-brown to seal brown, the usual stippling of blackish-fuscous varying in depth and density with the general intensification of the whole pattern. The shining blackish-fuscous areas on the sides of the pronotum, and also occasionally on the pleura and the sides of the proximal abdominal segments, are generally but not invariably correlated with the general intensification of the coloration. The caudal femora generally

show an infuscation of the external face of variable position and depth—this, however, may be absent. Generally this infuscation is ventral and rather solid, again it may be along the median line and narrow or wholly broken up into scattered marmorations. This latter condition is more pronounced in the male than in the female sex and apparently is purely individual. The ovipositor varies in color with the general tone. The entire ventral surface of the thorax and abdomen is bright yellow in the living specimens we have seen.

In this species the pale ochraceous of the disto-dorsal portion of the male tegmina is just as marked as in *testaceus* and *pachymerus*, and perfectly constant in the males seen. The pale border of the humeral sinus of the lateral lobes is equally constant in presence, but varies some in length and also in contrast, the latter largely due to the depth of the blackish of the adjacent portion of the lateral lobes. The latter feature is as variable as in the other species of the genus. One male from Arlington is most strikingly colored, reminding one of certain individuals of the Acridids, *Hippiscus phoenicopterus* and *Scirtetica marmorata*, as it has the entire dorsal surface of the head, pronotal disk and abdomen, except for a narrow median bar of the general brown color, of a uniform Rinnemann's green (Ridgway).

Measurements (in millimeters)

♂	Length of body	Greatest length of pronotum	Greatest (caudal) width of pronotal disk	Lateral length of tegmen	Length of caudal femur	Length of ovipositor
Sullivan County, New York....	18.9	8.2	5.7	4.7	16	....
Twin Lakes, Pennsylvania.....	17.4	8.4	5.9	5	16.3	....
Cove Mountain, Pennsylvania..	18.6	8.4	5.7	4.5	16	....
Rockville, Pennsylvania.....	21.4	8.2	5.9	4.5	16.3	....
Broad Top Mountain, Pennsylvania.....	16.8	7.7	5.2	4.1	15	....
Arlington, Virginia.....	20.4	9	6.4	4.5	17.5	....
Arlington, Virginia.....	23	9.5	6.4	5	18	....
Orange, Virginia, *Type*.....	22.2	8.2	5.8	5	16.3	....
Orange, Virginia, *Paratype*	21.5	7.9	5.9	3.5	15	....
Orange, Virginia, *Paratype*	23.1	8.5	6.1	4	15.5	....
Wyandotte, Indiana.....	20	9	6.2	5.5	17.6	....

Measurements (in millimeters)—Continued

♀	Length of body	Greatest length of pronotum	Greatest (caudal) width of pronotal disk	Lateral length of tegmen	Length of caudal femur	Length of ovipositor
Lake George, New York	24	9	6.3	....	20	21
East Jewett, New York	19	9	6	....	18	19.3
Ithaca, New York	17	8.4	5.6	....	17.4	19
Duncannon, Pennsylvania	20.5	8.6	5.5	....	19.3	21.7
Diamond Valley, Pennsylvania	19.6	7.8	4.9	....	17.3	18.7
Beatty, Pennsylvania	23.2	8.6	5.5	....	17.9	19.2
Beltsville, Maryland	21	8.7	6	....	17.6	21.5
Arlington, Virginia	23.3	9	6.1	....	20	21.5
Arlington, Virginia	26.5	9.3	6.1	....	20	21.8
Arlington, Virginia	23.7	9.2	6	....	20.9	20.5
Orange, Virginia, *Paratype*	19.4[20]	8.4	6	....	18.3	19.1
Orange, Virginia, *Allotype*	22.8	8.8	5.9	....	19	20
Orange, Virginia, *Paratype*	23.2	8.6	6	....	18.8	19.2
Orange, Virginia, *Paratype*	23.6	9	5.9	....	18.3	20.6
Stony Man Mountain, Virginia	20.7	8.1	5.5	....	16.4	20.5
Leetonia, Ohio	16[21]	8.5	5.9	....	17.1	18.4
Wyandotte, Indiana	23.9[22]	9.7	6.6	....	20.9	23.5
Vigo County, Indiana	21.5	9.4	6.1	....	20.5	23
Keokuk, Iowa	25	10.6	6.2	....	22.1	23

Geographic Variation.—Under this heading we have several features which need consideration. The species seems to be in process of breaking up into at least two forms, which, however, are not fixed enough to recognize by name and which are not quite absolute in their geographic correlation. One is a heavier, stockier type, with a generally more flaring caudal margin of the pronotum when seen from the side, relatively more robust caudal femora and heavier and straighter, although sometimes faintly arcuate, ovipositor. This type is that of the mountains of New York and portions of Pennsylvania, as well as Ohio, Indiana and Iowa. The other is a relatively more slender type without as much flare to the pronotum, relatively less robust caudal femora and more slender ovipositor, which latter generally has a slight decurvature of the ventral margin and a distinctly ventral apex.

[20] Abdomen compressed.

[21] Body badly shrivelled.

[22] Body bloated.

This type is that of portions of Virginia; Maryland and Pennsylvania individuals are also referable to it. However, certain specimens in both of the larger Virginia series in one or more of these features show the form similar to the type found at the other extreme of the specific range. The species *monticola*, the relationship of which to *davisi* we have already discussed, is in some respects more nearly related to the more northern type than to the more southern type of the *davisi* complex, so it would appear that the lower land type (*i. e.* the southern type of *davisi*) is probably the most recent development and the more northern form the more primitive. On account of the possession of a distinctly curved ovipositor and a characteristically formed subgenital plate in the female sex we would consider *monticola* the more specialized of the forms.

Aside from the features above treated we find that specimens of *davisi* from the higher elevations represented in Pennsylvania (Broad Top Mountain and Diamond Valley) and Virginia (Stony Man Mountain) show a reduction in size when compared with material from lower elevations. Material from the extreme borders of the range is little different in the proportions measured, aside from an increase in the length of the pronotum, caudal femora and of the ovipositor in material from Indiana and Iowa.

The ovipositor form variation, which has been treated under Morphological Notes, shows a geographic correlation; the females from Pennsylvania northward and from Ohio and Indiana have an ovipositor with a straight or very faintly convex ventral margin and an apex which is not truly ventral in position, while those specimens from Maryland south to Virginia have, as a rule, an ovipositor with the ventral margin straight or very faintly concave and the apex distinctly ventral. In the Arlington and Orange series, however, we find both types present.

Biological Notes.—From the available information it is seen that this species appears adult during the latter half of June and early July, and is present in that condition to at least the first week of September. The earliest date for mature specimens is June 16, at Great Falls, Virginia, and the latest September 7, at Diamond Valley, Pennsylvania. Immature individuals representing three instars were taken on June 4 at McConnellsburg, Pennsylvania, and others belonging to the same instars on June

25 on Meadow Mountain, Maryland. The locality at which the latter specimens were taken is at a considerable elevation (3000 feet) and this may account for the date discrepancy of equivalent material.

At Arlington, Virginia, the species, in company with *A. testaceus*, was taken in a variety of situations at night, by working with the aid of a flash-lamp. The Orange, Virginia, specimens were found, in company with *A. americanus*, locally not scarce in dead leaves and scattered green undergrowth of chestnut woods on Southwest Mountain.

Distribution.—From northern New York (Lake George) south to south-central Virginia, west to southern Iowa. The species is not known from the Appalachian region south of western Virginia (Stony Man Mountain and Hot Springs) and we have no Canadian or New England records.

Specimens Examined: 70: 21 ♂, 36 ♀, 5 juv. ♂, 8 juv. ♀.

Lake George, New York, VIII, 29, 1893, (J. L. Zabriskie), 1 ♀, [A. M. N. H.].

Catskill Mountains, New York, (W. T. Davis), 1 ♀, [Davis Cln.]; IX, 23 to 25, 1911, (E. T. Cresson Jr.), 1 ♀, [A. N. S. P.].

East Jewett, Catskill Mountains, New York, VIII, 8, 1914, (W. T. Davis), 1 ♀, [Davis Cln.].

Sullivan County, New York, 1887, (W. T. Davis), 1 ♂, [Davis Cln.].

Ithaca, New York, VII, 6, 1890, VIII, 5 and 6, 1885, (O. E. Pearce and Comstock), 2 ♀, 4 ♀, [Cornell Univ.].

Twin Lakes, Pennsylvania, VII, 15, 1914, (Chapman), 1 ♂, [Davis Cln.].

Enterline, Pennsylvania, VII, 17, 1912, (V. A. E. Daecke), 1 ♂, [Daecke Cln.].

Duncannon, Pennsylvania, VIII, 8, 1 ♀, [Pa. St. Dept. Zool.].

Cove Mountain, Pennsylvania, VIII, 23, 1914, (V. A. E. Daecke), 1 ♂, [Daecke Cln.].

Rockville, Pennsylvania, VII, 5, 1915, (V. A. E. Daecke), 1 ♂, [Daecke Cln.]; VII, 7, 1 ♂, [Pa. St. Dept. Zool.].

Broad Top Mountain, Pennsylvania, (Joseph Leidy), 1 ♂, [A. N. S. P.].[23]

Diamond Valley, Pennsylvania, IX, 7, 1905, (R.), 1 ♀, [A. N. S. P.].

McConnellsburg, Pennsylvania, VI, 4, 1905, (Witmer Stone), 1 juv. ♂, 3 juv. ♂, [A. N. S. P.].

Beatty, Pennsylvania, (Brugger), 2 ♀, [A. N. S. P.].

Meadow Mountain, Maryland, 3000 feet elev., VI, 25, 1907, (Witmer Stone), 2 juv. ♂, 3 juv. ♀, [A. N. S. P.].

Conowingo, Maryland, (Bayard Long), 1 juv. ♂, [A. N. S. P.].

Laurel, Maryland, VII, 15, 1883, 1 ♀, [Hebard Cln.].

Beltsville, Maryland, VIII, 16, 1909, (W. L. McAtee), 1 ♀, [U. S. N. M.].

Glenndale, Maryland, VII, 3, (Nellie Caudell), 1 juv. ♂, [U. S. N. M.].

[23] Recorded by Rehn as *A. dorsalis* (Entom. News, xiii, p. 315, (1902)).

Rock Creek, District of Columbia, V, 28, 1905, (D. H. Clemons), 1 juv. ♀, [U. S. N. M.].

Arlington, Virginia, VI, 9, 1914, (H.; taken at night with flash-lamp), 3 ♂, 5 ♀.

Fairfax County, Virginia, VI, 1911, (W. T. Davis), 1 ♀, [Davis Cln.].

Great Falls, Virginia, VI, 16, 1910, (W. T. Davis), 1 ♂, [Davis Cln.].

Falls Church, Virginia, VI, 24, 1915, (C. T. Greene), 1 ♀, [U. S. N. M.].

Green Dell Farm, two miles west of Pohick, Fairfax County, Virginia, VIII, 25, 1912, 1 ♂, [U. S. N. M.].

Orkney Springs, Virginia, (G. W. Hiflebower), 1 ♀, [U. S. N. M.].

Stony Man Mountain, Virginia, (Miss Pollock), 1 juv. ♀; VII, 28, 1912, (H. G. Dyar), 1 ♀, [U. S. N. M.].

Orange, Virginia, VII, 21, 1913, (R. & H.; in dead leaves and scattered green undergrowth in chestnut forest), 5 ♂, 8 ♀, *type, allotype* and *paratypes*, [Hebard Cln. and A. N. S. P.].

Hot Springs, Virginia, IX, 6, 1914, (Henry Fox), 1 ♂, [Fox Cln.].

Addison, Virginia, VIII, 27, 1914, (A. N. Caudell), 1 ♀, (U. S. N. M.].

Leetonia, Ohio, VII, 20, 1892, (H. G. Wolfgang), 1 ♀, [U. S. N. M.].

Lawrence County, Indiana, VII, 15, 1903, (W. S. Blatchley), 1 ♀, [Hebard Cln.].

Wyandotte, Indiana, VIII, 1905, (A. N. Caudell), 1 ♂, 1 ♀, [U. S. N. M.].

Keokuk, Iowa, VII, 19, 1913, (M. P. Somes; near rocks in timber at foot of bluff), 1 ♀, [Somes Cln.].

This species has been recorded by Mead as *A. dorsalis* from Ohio.

Atlanticus monticola Davis (Pl. VI, figs. 10, 11 and 12; pl. VII, figs. 4, 13 and 22; pl. VIII, figs. 6 and 14.)

1911. *Atlanticus pachymerus* Rehn and Hebard (not *Decticus pachymerus* Burmeister, 1838), Proc. Acad. Nat. Sci. Phila., 1910, p. 644. [Jones' Knob, North Carolina.]

1915. *Atlanticus monticola* Davis, Bull. Brooklyn Entom. Soc., ix, p. 104. [Lake Toxaway (type locality), Valley of the Black Mountains, Black Mountains, Balsam, Linville and Jones' Knob, North Carolina; Pinnacle Peak and Clayton, Georgia[24].]

This interesting form, which has quite a circumscribed range, is a close relative of *davisi*, agreeing in the general form and proportions, in the character of the tegminal development of the male, in the general form of the male cerci and in the type of the subgenital plate of the female, showing far greater affinity with

[24] Of the two immature males and one immature female from Clayton, Georgia, referred to this species by Davis, we are able to assign positively only the males. Of the females in this condition seen from that locality, all which can be identified with certainty are referable to *americanus*. Immature specimens of this genus are extremely hard to determine as many of the important features of diagnostic value are obscured or not fully revealed until the mature condition is reached.

that species than with the other members of this species group—*testaceus* and *pachymerus*. The present form and *davisi* may prove to be geographic races of the same species, but more conclusive evidence than we possess will be necessary to warrant us in so considering them. Proof of intergradation of the two in the Virginian mountains would make such action necessary.

In both sexes of *monticola* the eyes are somewhat more prominent than in *davisi*, the lateral angles of the pronotal disk are more sigmoid and more decidedly incurved caudad, while the contrast between the inflated proximal and slender distal portions of the caudal femora is more apparent and the latter section is relatively longer than in *davisi*. The male sex can also be separated from that sex of *davisi* by the marginal field of the tegmina being broader proximad and narrowing distad, instead of quite narrow and subequal as in *davisi*. The female sex of *monticola* can also be distinguished from that of *davisi* by the distinctly arcuate distal portion of the ovipositor, which is there distinctly upcurved and has an appreciable concavity to the dorsal margin, by the distal section of the ovipositor also narrowing to the submedian tip and by the median incision of the subgenital plate being broader and rounded at the bottom, thus in general more U-shaped.

Morphological Notes.—In this species the extremes of variation of pronotal form are very decided, being due not so much to the variation in width of the metazonal portion of the disk as to the variation in width of the greatest constriction of the carina of the prozona. All of the individuals with the more constricted form of pronotum are from the more northern (Virginia and West Virginia) or more elevated (Linville, Black Mountains, Jones' Knob) localities and the least constricted ones are from lower (Valley of Black Mountains, Lake Toxaway) or more southern (Pinnacle Peak) points. This correlation may be accidental and due to the small size of the series examined or it may be supported by collections made in the future. That this cephalic constriction is entirely independent of the varying proportion of the greatest caudal width to length is evident in figuring out, from the measurements, the ratios of the two. The greatest width varies in the males from 64 to 78 per cent of the length, in the females from 64 to 72 per cent. When the males showing the greatest amount of difference in

the cephalic constriction of the lateral carinae (viz. greatest—Shaver's Mountain, West Virginia; least—Pinnacle Peak, Georgia) are compared, no correlation with the ratio of the greatest (caudal) width to length is found. Of the extremes of constriction, one (Pinnacle Peak) shows the greatest or 78 per cent of greatest width ratio, the other (Shaver's Mountain) shows a proportion (73 per cent) much nearer this figure than, as one would imagine, to the other extreme of the series. The lack of correlation of the two features is quite evident. Of the females the Lake Toxaway paratype is relatively the narrowest over all. The Shaver's Mountain male has the least width of the pronotal disk contained two and one-third times in the greatest (caudal) width of the same, while the Pinnacle Peak male has the same proportions one and five-eighths times. The Washington County, Virginia, female has the same proportion one and two-thirds times and the Lake Toxaway specimens both show one and two-fifths. The cephalic margin of the pronotal disk varies from subtruncate to very shallowly subangulate emarginate. The caudal margin of the disk is moderately arcuate to arcuate-truncate with the lateral sections of this margin strongly arcuate. The lateral lobes of the pronotum show a well marked humeral sinus in both sexes, but the degree of indentation is variable.

The male tegmina vary but slightly in the degree of production caudad of the pronotum, while the vestigial female tegmina are well concealed. The disto-dorsal abdominal segment of the male is always angulate emarginate, the degree of the same varying from obtuse to nearly rectangulate. The supra-anal plate of the male varies greatly in form, from broad semi-elliptical to sharply rectangulate in outline, the medio-longitudinal sulcation continuous or limited to the proximal section. The cerci of the male vary appreciably in robustness and to a lesser degree in relative length, while the tooth is always disto-median in position and in form moderately incrassate and relatively uncinate; the distal section of the cercus shows some variation in attenuation. The male subgenital plate, as in most of the forms of the genus, shows a considerable degree of variation in the character of the emargination of the distal margin, this ranging from nearly truncate to U-emarginate, while the styles vary as much in length as in *davisi*, one male (Black Mountain) having them present as the

merest nodes. The ovipositor of the female, always, as far as our material goes, shows the characteristic dorsal curve of the distal section, although this is subject to some fluctuation in the degree of the curvature. The apex of the ovipositor is always nearer the median line than is usual in the genus and there is a slight and very gradual approximation of the margins distad. The depth of the ovipositor is relatively considerable and its length proportionate to the caudal femora appears to be well fixed. The female subgenital plate has the median emargination constant in form and diagnostic of the species. The prosternal spines, as in *davisi*, vary from the merest nodes to spines of medium length. The mesosternal lobes are always slightly acute-angulate with the apex submammillate.

Color Notes.—The coloration of this species varies greatly; in several specimens the base color of the limbs, and in one, of the pronotum, is pale ochraceous. Some individuals have pencillings of blackish fuscous on the dorsum of the pronotum and abdomen and heavy stipplings and cloudings of the same on the limbs, while the majority of the specimens show a narrow median or a broad medio-ventral area of the same blackish fuscous on the external face of the caudal femora, although several representatives have this absent. In addition several specimens show cloudings of fuscous proximad, mesad and distad on the caudal femora and distal clouds on the other femora, these more evident in the pale specimens. The fuscous of the lateral lobes of the pronotum varies in proportion to the contrast of the pattern. These color differences are irrespective of sex.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Greatest (caudal) width of pronotum	Lateral length of tegmen	Length of caudal femur	Length of ovipositor
Shaver's Mountain, West Virginia	17.6	8	5.9	4.6	14.8	....
Linville, North Carolina, *Paratype*	18	8.2	5.7	5.4	16.8	....
Black Mountains, North Carolina, *Paratype*	19	8.2	5.9	5.4	17.9	....

Measurements (in millimeters)—Continued

♂	Length of body	Length of pronotum	Greatest (caudal) width of pronotum	Lateral length of tegmen	Length of caudal femur	Length of ovipositor
Valley of Black Mountain, North Carolina, *Paratype* ...	19.5	9	5.8	5.2	18.8	....
Jones' Knob, North Carolina, 6000 feet, *Paratype*.....	18.5	8.7	6.4	6	17.7	....
Jones' Knob, North Carolina, *Paratype*.....	18.8	8.7	6	5	17.9	....
Pinnacle Peak, Georgia, *Paratype* ♂.....	19.8	7.6	6	4.4	18	....
♀						
Washington County, Virginia ..	22.7	8.9	6.3	....	20.2	[25]
Valley of Black Mountain, North Carolina, *Paratype* ...	20.6	8.9	6.1	....	20	19.4
Jones' Knob, North Carolina, *Paratype*.....	21.3	8.8	6.3	....	19	19
Lake Toxaway, North Carolina, *Type*.....	20	8.3	6	....	18.5	18.5
Lake Toxaway, North Carolina, *Paratype*.....	23.2	9.9	5.7	....	19.6	17.6

Geographic Variation.—Our material is too scanty to reach any definite conclusions regarding this type of variation in the present species. However, as we have stated above under Morphological Notes, the individuals with the relatively greatest cephalic constriction of the pronotal disk are from the more northern or more elevated localities and those with the least constriction from the lower or more southern ones. Whether additional material will give more light on this point remains to be seen. The female from Washington County, Virginia, has the subgenital plate more narrowly emarginate than the other material, but the form is typically that of *monticola*.

Biological Notes.—From the material at present available this species is seen to reach maturity as early as July 28 (Linville, North Carolina) and to occur as late as October 7 (Jones' Knob). We know the insect is adult at Jones' Knob from August 19 to the last date given above. The only information we have on the

[25] Ovipositor broken in this specimen.

habits of *monticola* is that, at Jones' Knob, it occurred in the undergrowth of the deciduous forest immediately below the spruce belt.

Distribution.—The more elevated areas of the southern Appalachian region, the known localities being almost entirely above an elevation of three thousand feet, the highest record being from six thousand feet. The most northern locality known is Shaver's Mountain near Durbin, West Virginia and the most southern, Clayton, Rabun County, Georgia.

Remarks.—As we have said above this insect and *davisi* may prove to be forms of the same species, one possibly being the equivalent of the other in a more restricted and peculiar (*monticola*) or a more extended and varied (*davisi*) environment. We have already commented upon this under *davisi*.

Specimens Examined: 14; 7 ♂, 5 ♀, 2 juv. ♂.

Shaver's Mountain, Durbin, West Virginia, 3500 feet elevation, VIII, 26, 1909, (A. D. Hopkins), 1 ♂, [U. S. N. M.].

Washington County, Virginia, (E. A. Smyth Jr.), 1 ♀, [Hebard Cln.].

Linville, North Carolina, VII, 18, 1903, (A. P. Morse), 1 ♂, *paratype*, [Morse Cln.].

Black Mountains, North Carolina, IX, (C. Schaeffer), 1 ♂, *paratype*, [Bklyn. Inst. A. & S.].

Valley of Black Mountain, North Carolina, VIII, 5 to 30, 1906, (W. Beutenmüller), 1 ♂, 1 ♀, *paratypes*. [A. M. N. H.].

Jones' Knob, Balsam Mountains, VIII, 19, 1903, (A. P. Morse,) 1 ♂, 1 ♀, *paratypes*, [Morse Cln.]; 6000 feet elevation, X, 7, 1905, (M. Hebard; in undergrowth of deciduous forest), 1 ♂, *paratype*, [Hebard Cln.].

Lake Toxaway, North Carolina, (Mrs. A. T. Slosson), 2 ♀, *type* and *paratype*, [Davis Cln.].

Pinnacle Peak, Rabun County, Georgia, VIII, 20, 1913, (J. C. Bradley), 1 ♂, *paratype*, [A. N. S. P.].

Clayton, Georgia, 2000 to 3700 feet elevation, VI, 1909, (W. T. Davis), 2 juv. ♂, [Davis Cln.].

Atlanticus americanus (Saussure) (Pl. VI, figs. 13, 14 and 21; pl. VII, figs. 5, 14, and 23; pl. VIII, figs. 7 and 15.)

1859. *O[rchesticus] americanus* Saussure, Revue et Magasin de Zoologie, 2e ser., xi, p. 201. [Tennessee.]

1862. *T[hyrconotus] dorsalis* Scudder (not *Decticus dorsalis* Burmeister, 1838), Boston Journ. Nat. Hist., vii, p. 454. [Massachusetts; Rhode Island; Maryland.]

1869. *Decticus derogatus* Walker, Catal. Derm. Salt. Brit. Mus., ii, p. 260. [Massachusetts.]

1894. [*Atlanticus*] *dorsalis* Scudder (not *Decticus dorsalis* Burmeister, 1838), Canad. Entom., xxvi, pp. 179, 180, 183. (In key to species of genus.)
1900. *Stipator americanus* Rehn, Trans. Amer. Entom. Soc., xxvii, p. 90. (Bare combination.)
1907. *Atlanticus dorsalis* Caudell, Proc. U. S. Nat. Mus., xxxii, p. 321, fig. 26. (Part.) [Maryland; Virginia; District of Columbia; Mississippi.] (*Atlanticus dorsalis* of authors.)

The nomenclatorial tangles of the present species have been due almost entirely to two unfortunate misidentifications by Scudder. The first was the determination of the present species as Burmeister's *dorsalis*, which, like the similar one of *pachymerus*, was pardonable on account of the lack of material of true *dorsalis*. We now know, however, that the present species does not occur in the region from which the typical material of *dorsalis* probably came (*i. e.* the coastal region of South Carolina). The other error was the identification of Saussure's *Orchesticus americanus* as a member of a related genus, which is not known from east of the trans-Mississippean prairie and plain region, for which the name *Orchesticus* and later *Stipator* have been used. For comments on these generic names see remarks made under the generic treatment. The original generic and specific descriptions of *americanus* are sufficiently full to bring out the following features possessed by Saussure's species: pronotum subcarinate, margins of the median area sinuate; caudal femora beneath finely spined; ovipositor straight, very long (30 mm.); coloration fuscous, lineate with yellow on both sides in pronotal sinus. Of these features none apply to the forms of the genus for which Scudder and other authors have used the name, while all are descriptive of the *Atlanticus* found in Tennessee, the type locality.

Walker's *derogatus* is identical with the present species; Kirby[26] so considered it and Mr. Caudell has kindly supplied us with notes and measurements made by him from the type which fully corroborate Kirby's assignment.

This species is easily recognized when compared with the other forms of the genus, the characters given in the key being sufficient to distinguish it. The male will under no circumstance cause the least hesitation in recognition, on account of cercal and tegminal characters, and the female can invariably be recognized by the deep division of the subgenital plate, the lateral portions of which

[26] Syn. Catal. Orth., ii, p. 181, (1906).

are sublanceolate and more produced than in any of the other forms of the genus. True *dorsalis* can be readily distinguished, in addition, by the weak lateral carinae of the pronotal disk and the more elongate and more slender caudal femora.

Morphological Notes.—This species exhibits the same amount of variation in the relative proportion of the greatest (caudal) width of pronotal disk to length of the same, as found in *davisi* and the other species treated in the preceding pages. In the male sex alone this ratio varies from 56 to 64 per cent and in the two females from Lookout Mountain, Tennessee, the variation is so great that we get the decidedly different ratios of 54 and 67 per cent. The remarks we have already made regarding the non-correlation of this ratio difference with the width of the area of greatest convergence of the lateral carinae of the disk, *i. e.* at cephalic third to fourth, is strikingly illustrated and supported by these two Lookout Mountain specimens, as while they are so strikingly different in their other ratios they have exactly the same least width of the disk. The cephalic margin of the disk of the pronotum varies from subtruncate to distinctly arcuato-emarginate, and this in the large Dias Creek series alone. The caudal margin of the pronotal disk is always well arcuate and though the degree of the same varies that portion is never subtruncate. The lateral lobes of the pronotum have little variation in the form of the humeral sinus, which is broad and relatively well indicated. The disto-dorsal abdominal segment in both sexes is always angularly emarginate mesad, the exact angle varying somewhat and the deeper portion of the angle is more or less rotundate. The supra-anal plate of the male is always trigonal and sulcate. The cerci of the male show a considerable amount of individual variation in material from the same locality and also some geographic difference, this being due to an attenuation or a shortening and thickening of the cercus, the tooth holding relatively the same position in all. In the more robust type of cercus, the proximal portion is slightly disproportionately thickened. The tooth varies little in character, but is more decided and heavier in southern specimens. The male subgenital plate is always fissate, the apparent degree depending on the amount to which the plate has been compressed in drying, and the styles vary

individually as much in length as in the other species of the genus. The supra-anal plate of the female is similar to that of the male but more obtuse. The form of the ovipositor is fairly uniform, being always straight except in a few individuals which show the faintest decurvature, while the relative depth shows little variation and the apex is always ventral. As a general rule the ovipositor is slightly shorter than the caudal femur, two specimens, however, showing a difference in the length in favor of the ovipositor of as much as 2.1 to 7.6 millimeters. The degree of difference in the length in favor of the femoral length appears to increase southward, but our evidence is not conclusive on this point. The subgenital plate of the female shows no noteworthy variation in its distinctive form. The prosternal spines vary in length from mere nodes to aciculate spines of medium length, while the mesosternal lobes range in form from distinctly acute-angled to rectangulate, the immediate apex faintly mammillate.

The females from Holly Springs and Winona, Mississippi, are noteworthy in having relatively shorter and broader ovipositors than is usual in the species. The specimens are, however, representative of this form, although they may indicate a variation developed from the more usual type at this extreme point of the range of the species. The two females from Meridian, Mississippi, are similar in this respect to more eastern specimens.

Color Notes.—The color variations found in this species are essentially those occurring in most of the forms of the genus, in general a range of the body color from ochraceous tones to dark umber shades, as well as diminution or intensification of the shining blackish fuscous area on the lateral lobes of the pronotum, the two features in no way correlated. The difference from the other species appears to be that but very rarely does the blackish fuscous color appear on the pleura or any of the abdominal segments, which almost invariably remain of the general tone. The minute "pepper and salt" character of the pattern is indicated in all the specimens seen.

In certain individuals, most of which are from the southern states, a longitudinal series of blackish fuscous quadrate spots are indicated along the line on which the traces of the lateral carinae of the abdomen are situated, more particularly ventrad

of these spots are placed a number of parallel series of similar but much smaller dots. These markings are independent of the depth of the pronotal infuscation. The male tegmina show some little variation in the strength and shade of the ochraceous disto-dorsal patch. The caudal femora vary in the intensity and general size of the usually present marmorations, there also occasionally being a fine medio-longitudinal line on the external face. In certain strongly contrasted individuals from River Junction, Florida, the external face of the caudal femora is heavily infuscate.

Measurements (in millimeters)

♂	Length of body	Greatest length of pronotum	Greatest (caudal) width of pronotal disk	Lateral length of tegmen	Length of caudal femur	Length of ovipositor
Staten Island, New York	20	9.9	5.7	5.1	22.9	....
Staten Island, New York	20.8	9.5	5.7	4.8	23.4	....
Dias Creek, New Jersey. Average and extremes of ten specimens	23.8 (21.2–25.7)	9.4 (9–10)	5.8 (5.2–6.2)	5.1 (4.8–5.7)	22.1 (20.8–23.6)	....
Orange, Virginia	26	10	6.3	5.1	26.3	....
Orange, Virginia	28.3	10.3	6.6	5.8	24.7	....
Greensboro, North Carolina	30.7[27]	11	6.6	5.8	25.5	....
Topton, North Carolina	21.8	9.2	6	5.3	22.3	....
Murphy, North Carolina	23.5	10.8	6.9	5.8	25	....
Tuckoluge Creek, Georgia	20.8	9.4	5.4	5.3	22	....
Tuckoluge Creek, Georgia	19.6	9.5	6	4.7	23	....
River Junction, Florida	25.4	10.5	6.4	5.5	27.8	....
River Junction, Florida	24	9.6	6.1	5.4	27.4	....
Chehawhaw Mountain, Alabama	26.3	10.5	6.8	5.2	27	....

[27] Abdomen slightly stretched in stuffing.

Measurements (in millimeters)—Continued

	Length of body	Greatest length of pronotum	Greatest (caudal) width of pronotal disk	Lateral length of tegmen	Length of caudal femur	Length of ovipositor
♂						
Winona, Mississippi	24.7	10.5	6.6	6.2	26.6	....
Meridian, Mississippi	24.8	10.2	6	5.7	27.2	....
Natchez, Mississippi	25.3	10.2	6.2	5.4	27.3	....
♀						
Massachusetts. *Type* of *Decticus derogatus* Walker.[28]	....	10	....	....	26	27
Dedham, Massachusetts	21.8	11.1	6.2	....	26.6	25.8
Staten Island, New York.....	20	9.9	6	....	24.3	25
Staten Island, New York.....	29	10.4	6.5	....	25.8	25.8
Dias Creek, New Jersey. Average and extremes of ten specimens.....	24.4 (21.5–26.4)	10 (9.7–10.3)	6.2 (6–6.6)	....	24.9 (23–26.5)	24.1 (22.7–27)
Cabin John Run, Maryland.....	22.2	9.9	6.3	....	25	26
Roanoke, Virginia ..	29.3	10.5	6.4	....	27.2	25
Sulphur Springs, North Carolina...	24.2	10.2	6.2	....	25.6	26.3
Greensboro, North Carolina.....	29	11.3	6.6	....	29.4	26.8
Greensboro, North Carolina.....	27	10.9	6.3	....	28	25.5
Greensboro, North Carolina	27.4	11	6.7	....	29.4	26
Waynesville, North Carolina	24	10.2	6.7	....	24.6	26.7
Andrews, North Carolina.....	26.	10.8	6.6	....	28	28.3
Murphy, North Carolina.....	27.5	10.2	6.5	....	27.8	26.3
Tuckoluge Creek, Georgia	25	10	6.5	....	27	24.8
Jasper, Georgia....	28.4	10.5	6.4	....	28.1	24.8

[28] Measurements made and kindly supplied by Mr. A. N. Caudell.

Measurements (in millimeters)—Concluded

♂	Length of body	Greatest length of pronotum	Greatest (caudal) width of pronotal disk	Lateral length of tegmen	Length of caudal femur	Length of ovipositor
Lost Mountain, Georgia	25.9	10.9	6.8	....	28.2	25.9
Bainbridge, Georgia	25.2	10.2	6	....	29	26.4
River Junction, Florida	23.8	10.6	6.2	....	29.2	28
River Junction, Florida	28.4	11.7	7.3	....	32.2	31.2
Tennessee (ex Saussure)						30
Lookout Mountain, Tennessee	28.3	11	6.8	....	30.2	28.6
Lookout Mountain, Tennessee	29.5	11.5	6.5	....	28	25.3
Opelika, Alabama	27.2	12	7	....	29.5	29.5
Opelika, Alabama	26.5	10.7	6.2	....	28.4	26.3
Holly Springs, Mississippi	30[29]	12	7	....	30.6	23
Winona, Mississippi	27	12	7.3	....	30.4	25.6
Meridian, Mississippi	26.4	11	6.4	....	31	30.5

Geographic Variation.—It is evident, from the above measurements, that as one passes to the south and southwestward over the range of this species, the individuals from the highest elevations remain of approximately similar size to those from the more northern localities, while in the valleys and on the lower elevations the individuals are progressively larger, the maximum being reached in northern Florida, central Alabama and the whole of Mississippi. The best index to this increase is furnished by the length of the caudal femur. It is also noteworthy, although not so conclusively demonstrated, that the ratio of the length of the caudal femur to that of the ovipositor changes from but slightly, to distinctly, in favor of the femur as we proceed southward. In northern Mississippi (Holly Springs and Winona) there appears to be developing an incipient race, with a much shorter and heavier ovipositor. Meridian, Mississippi specimens are of the usual type. Males from northern

[29] Body abnormally compressed.

Florida and southern Mississippi show an elongation of the distal section of the cercus, which is distinctly more attenuate than in individuals from the Carolinas and northward.

Biological Notes.—The earliest date we have for this species to reach maturity in the northern states is July 15 at Pink Hill, Pennsylvania, when and where an immature specimen in the instar preceding maturity was also taken. In the southern states it matures somewhat earlier, as our material shows dates as early as July 8 (Sand Mountain, Georgia). At higher elevations in the southern states the development of the species may be slower, as our July material from points in Rabun County, Georgia, is largely immature, but we lack specific information. At Dias Creek, New Jersey, on July 20, both mature and immature specimens were taken, and at Pink Hill, Pennsylvania, on July 1, only immature individuals were found. On July 9, at Arlington, Virginia, all material taken (five specimens) was in the instar preceding maturity.

The present species is a frequenter of the areas of dead leaves and low undergrowth in pine and deciduous forest, occasionally being more numerous along the edge of the timber than in the depth of the woods. Its presence will often be signalized by the patter on the leaves as it jumps away from the disturbing footsteps. The insects are so thoroughly protected by their coloration that it is often difficult to see them, even when moving, much less when stationary. Their activities are chiefly nocturnal and work with a flash-lamp will sometimes reveal them in many situations.

Distribution.—The range of the species covers the Carolinian life zone and also portions of the Alleghanian and Austroriparian zones, and extends from central New England (Dedham, Massachusetts and possibly New Hampshire) south to northern Florida (River Junction), central Alabama (Opelika) and south-central Mississippi (Natchez), west to the last mentioned locality. In no case have we seen material from west of the Appalachians in the northern portion of the range of the species, but southward it occurs in the drainage basin of the Tennessee River, while it is found as far north in the general Mississippi Valley region as Holly Springs, Mississippi. In New York and New Jersey, the range covers the coastal region and Costal Plain area, but in

Virginia and North Carolina, it occurs in the Piedmont and in the large valleys of the Tennessee in North Carolina, in the latter state leaving the vicinity of the coast. The species is not known from the vicinity of the coast south of Virginia Beach, Virginia. In Pennsylvania and New York the species appears to be absent from the more elevated country, where it is replaced by *A. davisi*, both forms occurring together, however, at localities in Virginia. A record of this species from Sudbury, Vermont, made by Scudder, probably refers to *A. davisi*, which is found in the same region, while the present species appears to be absent.[30] The vertical distribution of this species appears to be from sea-level in the north, to 3000 to 4000 feet above the same in North Carolina (Topton).

Specimens Examined: 162; 52 ♂, 79 ♀, 10 juv. ♂, 21 juv. ♀.

Dedham, Massachusetts, VIII, 1897, (F. H. Sprague), 1 ♀, [M. C. Z.].

Yaphank, Long Island, New York, IX, 5, 1911, (W. T. Davis), 1 ♀, [Davis Cln.].

East Quogue, Long Island, New York, VIII, 1899, (W. T. Davis), 1 ♀, [Davis Cln.].

Staten Island, New York, VII, 1895, VIII, IX, 8, IX, 1893, late fall, (W. T. Davis), 3 ♂, 2 ♀, [Davis Cln.].

Jamesburg, New Jersey, VIII, 31, IX, 23, 1904, (W. T. Davis), 1 ♂, 1 ♀, [Davis Cln.].

Lakehurst, New Jersey, IX, 6 and 13, X, 10, 1914, (W. T. Davis), 5 ♀, [Davis Cln.].

Cassville, New Jersey, VIII, 1910, (W. T. Davis), 1 ♂, [Davis Cln.].

Pasadena, New Jersey, VIII, 11, 1914, (H. K. Plank; on cranberry bog), 1 ♀, [U. S. N. M.].

Stafford's Forge, New Jersey, VIII, 24, 1914; (R.; in oak scrub, sweet fern and huckleberry low undergrowth) 1 ♂, 1 ♀.

West Creek, New Jersey, VIII, 28, 1914, (R.; trapped in molasses jar in oak and pine woods), 1 ♀.

Tuckerton, New Jersey, VIII, 31, (W. T. Davis), 1 ♀, [Davis Cln.].

Parkdale, New Jersey, VII, 30, 1911, (R. & H.), 1 juv. ♀.

Atsion, New Jersey, VII, 30, 1911, (R. & H.), 1 ♀.

Reega, New Jersey, VII, 31, VIII, 1 to 4, 1914, (H.; in undergrowth of pine forest), 1 ♂, 2 ♀.

Dennisville, New Jersey, IX, 7, 1908, (W. T. Davis), 1 ♀, [Davis Cln.].

Swainton, New Jersey, VIII, 21, 1914, (H.; in pine woods undergrowth), 1 ♀.

[30] Caudell (Proc. U. S. Nat. Mus., xxxii, p. 321, (1907)) has recorded immature examples of *dorsalis* from Arizona, Florida and California. Those from Florida represent true *dorsalis* but the immature individuals from the western states represent other genera.

Dias Creek, New Jersey, VII, 20, 27 and 31, VIII, 1 to 8, 1914, (H.; in dead leaves and among huckleberry bushes in deciduous forest), 22 ♂, 25 ♀, 1 juv. ♂, 2 juv. ♀.

Wildwood Junction, New Jersey, VII, 27, 1914, (H.; undergrowth in oak woods), 2 ♂.

West of Bennett, New Jersey, IX, 25, 1915, (B. Long; in dry woods), 1 ♀, [A. N. S. P.].

Pink Hill, Pennsylvania, VII, 1, 1910. VII, 15, 1911, (R. & H.; in open woods on serpentine barrens), 1 ♂, 2 juv. ♂, 1 juv. ♀.

Cabin John Run, Maryland, IX, 19, 1911, (W. T. Davis), 1 ♀, [Davis Cln.].

Plummer's Island, Maryland, VIII, 11, 1907, (W. L. McAtee), 1 ♀, [U. S. N. M.].

Washington, District of Columbia, 1 juv. ♂, 1 juv. ♀, ; VIII, 30, 1914, (A. N. Caudell; in woods), 1 ♂, [U. S. N. M.].

Arlington, Virginia, VII, 9, 1911, (H.; taken in a variety of situations at night with flash-lamp), 2 juv. ♂, 3 juv. ♀.

Clarendon, Virginia, VI, 8, 1914, (H. A. Allard), 1 juv. ♀, [U. S. N. M.].

Falls Church, Virginia, VIII, 20, 1 ♀, [U. S. N. M.].

Seven-mile Ford, Virginia, VIII, 19, 1900, 1 ♀, [Morse Cln.].

Orange, Virginia, VII, 21, 1913, (R. & H.; in dead leaves and scattered green undergrowth in chestnut woods), 2 ♂, 1 juv. ♂, 5 juv. ♀.

Roanoke, Virginia, IX, 6, 1903, (A. P. Morse), 1 ♀, [Morse Cln.].

Virginia Beach, Virginia, IX, 20, 1914, (H. Fox), 1 ♂, [Fox Cln.].

Greensboro, North Carolina, VII, 26, 1913, (R. & H.; one small colony in leaves among grasses in deciduous forest), 1 ♂, 4 ♀.

Sulphur Springs, North Carolina, IX, 24, 1904, (H.), 4 ♀.[31]

Waynesville, North Carolina, 2500 to 3000 feet elevation, IX, 14, 1908, (Z. P. Metcalf), 1 ♀, [N. C. Dept. Agr.].

Lake Toxaway, North Carolina, (Mrs. A. T. Slosson), 1 ♀, [Davis Cln.].

Topton, North Carolina, 3000 to 4000 feet elevation, VIII, 21, 1903, (A. P. Morse), 1 ♂, [Morse Cln.].

Andrews, North Carolina, VIII, 21, 1908, (F. Sherman), 1 ♀, [N. C. Dept. Agr.].

Murphy, North Carolina, VII, 25, and VIII, 22, 1903, (A. P. Morse), 1 ♂, 1 ♀, [Morse Cln.].

Lookout Mountain, Tennessee, VIII, 23, 1903, (A. P. Morse), 2 ♀, [Morse Cln.].

Clayton, Georgia, 2000 to 3700 feet elevation, VI, 1909, (W. T. Davis), 3 juv. ♂, 3 juv. ♀, [Davis Cln.].

Tuckoluge Creek, Rabun County, Georgia, VII, 1910, (W. T. Davis), 2 ♂, 1 ♀, 1 juv. ♀, [Davis Cln.].[32]

Rabun Bald, Georgia, VII, 1910, (W. T. Davis), 1 juv. ♀, [Davis Cln.].

[31] Previously recorded as *dorsalis* by Rehn and Hebard (Proc. Acad. Nat. Sci. Phila., 1910, p. 644, (1911)).

[32] Recorded as *dorsalis* by Davis (Journ. N. Y. Entom. Soc., xix, p. 218, (1911)).

Top of Pinnacle Peak, Georgia, VII, 1910, (W. T. Davis), 1 juv. ♀, [Davis Cln.].

Tallulah Falls, Georgia, VI, 19 to 23, 1909, (J. C. Bradley), 1 juv. ♀, [Ga. State Cln.].[33]

Sand Mountain, Georgia, VII, 8, 1905, (A. P. Morse), 1 ♀, [Morse Cln.].

Jasper, Georgia, VII, 26, 1903, (A. P. Morse), 1 ♀, [Morse Cln.].

Lost Mountain, Georgia, VII, 13, 1913, (J. C. Bradley), 1 ♀, [Ga. State Cln.].

Bainbridge, Georgia, IX, 5, 1915, (R. & H.; on dead leaves under water oaks near lake), 1 ♂, 1 ♀.

River Junction, Florida, VIII, 31, 1915, (R. & H.; among tree shoots in heavy forest of beech, hickory, oak, magnolia, etc., on limestone hills), 5 ♂, 4 ♀.

Chehawhaw Mountain, Alabama, 2400 feet elevation, VII, 13, 1905, (A. P. Morse), 1 ♂, [Morse Cln.].

Opelika, Alabama, VIII, 2, 1915, (H.; in heavy thicket near stream in woods), 1 ♂,1 ♀.

Holly Springs, Mississippi, VII, 12, 1910, (E. H. Raidle), 1 ♀, [U. S. N. M.].

Winona, Mississippi, IX, 15, 1915, (H.; in dead leaves under scrub in mixed forest on hillside), 1 ♂, 1 ♀.

Meridian, Mississippi, IX, 10, 1915, (H.; in open areas with sparse partridge-berry and other small plants and vines in oak, sweet gum and tulip woods on low hills), 1 ♂, 2 ♀.

Natchez, Mississippi, IX, 13, 1915, (R.; hopping over dead oak leaves in dense low woods on high ground east of town), 1 ♂.

Atlanticus gibbosus Scudder (Pl. VI, fig. 15, 16 and 22; pl. VII, figs. 6, 15 and 24; pl. VIII, figs. 8 and 16.)

1877. *Thyreonotus dorsalis* Scudder, Proc. Bost. Soc. Nat. Hist., xix, p. 83. (Part.) [Fort Reed, Florida.]

1894. [*Atlanticus*] *gibbosus* Scudder, Canad. Entom. xxvi, p. 180. [North Carolina; Florida.]

1907. *Atlanticus gibbosus* Caudell, Proc. U. S. Nat. Mus., xxxii, p. 326, fig. 31. [Florida; North Carolina.]

This striking species is one of the easiest forms of the genus to recognize. The rounded yet clearly indicated lateral carinae of the pronotal disk in both sexes will serve to distinguish this form, while the strongly arcuate character of the caudal margin of the same disk and the great length of the lateral lobes of the pronotum will also prove of service. The form of the male cercus is unique in the genus.

Morphological Notes.—In this species the pronotal form exhibits the same features of individual variation found in other members of the genus, the greatest (caudal) width of the disk

[33] Previously recorded by the present authors as *dorsalis* (Proc. Acad. Nat. Sci. Phila., 1910, p. 596, (1911)).

showing a proportion to length of from 50 to 58 per cent in the female. Of these figures the Billy's Island males alone show from 51 to 58 per cent in the male and 53 to 58 per cent in the female. The area of least width is as little correlated with the relative caudal width proportion as in the other species, but the general form of the disk is more uniform in this species than in other forms. The lateral carinae of the pronotal disk vary but slightly in the degree of their indication. The cephalic margin of the pronotal disk varies from subtruncate to shallowly arcuato-emarginate; the caudal margin is always greatly arcuate. The lateral lobes of the pronotum have their greatest depth contained twice or nearly twice in their greatest dorsal length, while there is some variation in the truncation or arcuation of the ventral margin of the same; the humeral sinus is slightly more indicated in some specimens than in others, but in all it is weak or subobsolete. The male tegmina reach, but generally do not surpass, the caudal margin of the pronotal disk, in several specimens they project slightly. The female tegmina are deeply buried under the pronotum. The usual dorsal and lateral carinae of the abdomen are at most but weakly indicated in this species, generally being obsolete. The disto-dorsal abdominal segment is angulato-emarginate mesad in both sexes; in the male the angle varies from acute to rectangulate, in the female it is rotundato-obtuse, the resultant lateral angles moderately sharp. The supra-anal plate is acute in both sexes. Cerci of the male uniform in their form and curvature. Subgenital plate of the male always fissate-emarginate, styles moderately long and not appreciably varying in length. Ovipositor always robust and straight, the apex ventral, the length, as shown by the measurements, varying from 21.2 to 29.2 mm. and not correlated with that of the caudal femora. Subgenital plate of the female with the median emargination moderately deep and narrow, almost fissate, the lateral sections well rounded. Prosternal spines always well developed and aciculate, occasionally very long; mesosternal lobes varying from but slightly more acute than rectangulate to strongly acute-angulate. The caudal femora vary in length in a manner largely correlated with general size; the ventro-internal margins bears a series of spines varying in number from two to nine. The median disto-internal spur of

the caudal tibiae is but slightly longer than the dorsal disto-internal one.

The immature males examined by us show that as early as the second instar preceding maturity (Jacksonville) the characteristic form of the cercus is clearly indicated, while in similar individuals of the female sex (Hastings) the general form and character of the pronotum is sufficiently pronounced to enable one to place the material.

Color Notes.—The general color in this species ranges from bister through mummy brown, prout's brown, cinnamon brown, tawny to cinnamon, with a few specimens washed with hazel. Over this, of course, is the "pepper and salt" of the fuscous overcolor, of a variable density and distinctness, the marmorations on the limbs varying with this and the lateral sections of the abdomen heavily stippled in the specimens with the densest overcolor. The blackish fuscous pattern of the lateral lobes of the pronotum is more extensive than in any other species of the genus except *calcaratus*, and when it is fully indicated its ventral margin is of an approximately similar form to that found in the other species. In its most extreme condition this fuscous marking covers all of the lobes except a broad marginal area including all the ventral margin and the caudal margin to the usual position of the sinus, as well as a relatively small dorsal section of the metapleura. The usual pale humeral sinus marking is frequently but a small semicircular spot, which, however, is generally connected with the pale ventral section of the lobes. The interantennal region and the proximal antennal joint is always washed with blackish fuscous in individuals with the heavily infuscated pronotal lobes. At the base of all the femoral and all the tibial spines, with the exception of the dorso-caudal, are fuscous markings, and occasionally there is a more or less complete annulus of the same proximad on the cephalic tibiae. The tegmina of the male have a strong disto-sutural blotch of fuscous.

Measurements (in millimeters)

	Length of body	Greatest length of pronotal disk	Greatest (caudal) width of pronotal disk	Length of caudal femur	Length of ovipositor
♂					
Sandfly, Georgia	33.3	13.8	7.5	32.7	....
Sandfly, Georgia	32	13	6.9	31.5	....
Billy's Island, Georgia. Average and extremes of six specimens	30.9 (28.6–33)	13.9 (13.7–14.1)	7.6 (7.2–7.9)	33.8 (33–34.8)	....
Spring Creek, Georgia	26	12.6	6.8	29.5	....
Tallahassee, Florida	32	11.6	6.7	28.5	....
Carabelle, Florida	28.8	12.8	7	30.5	....
Pablo Beach, Florida	29	13	7	33.7	....
Lake City, Florida	31.5	13.9	7.6	33.5	....
♀					
Florence, South Carolina	34.4	13.4	7.8	33.8	25.4
Magnolia, South Carolina	31.4	13.1	7.5	33	25
Currahee Mountain, Georgia	32.8	12.8	7.1	31.7	21.2
Warm Springs, Georgia	29	13.5	7.4	32.4	23.4
Sandfly, Georgia	33	13.4	7.7	34	26.9
Billy's Island, Georgia. Average and extremes of four specimens	29.4 (27.2–32.6)	14.2 (14–14.7)	7.9 (7.6–8.2)	36.5 (36–37)	27.5 (27–27.5)
Crestview, Florida	30.5	14.6	8	35.5	27.8
Tallahassee, Florida	31.8	13.6	7.9	34	28.6
Atlantic Beach, Florida	32.6	12.5	7.1	32.4	28.7
Pablo Beach, Florida	28	12.5	7.2	34.5	29.2
Lake City, Florida	29.2	(broken)	8.2	36.7	29
Merritt, Florida	27.6	13.4	7.8	35.2	27.5

We have not given the length of the tegmen in the males, as in the majority of specimens of that sex they are completely covered by the pronotum.

Geographic Variation.—The only structural feature which seems to have geographic correlation in its variation is the length of the ovipositor of the female, this being shorter in the specimens from the more northern (Florence and Magnolia, South Carolina) and the more elevated (Currahee Mountain and Warm Springs,

Georgia) localities, when compared with the length of the same in the individuals from northern Florida and southern Georgia. The general size and length of the pronotum and caudal femora show no geographic correlation in their variation. The Billy's Island individuals of both sexes, however, represent the optimum development of the species.

Biological Notes.—This striking species is chiefly an inhabitant of pine and mixed pine and oak woods, where it lives among the dead leaves in the undergrowth of low bushes and in wire grass. Individuals jump with considerable agility considering their bulk and are capable of defending themselves vigorously with their powerful jaws. The earliest exact record is June 9 at Lake City, Florida, while adults and immature specimens from Billy's Island, Georgia are labelled June and an adult from Bainbridge, Georgia was taken between June 7 and 23. The latest date for adults is October 15 to 16, at Crestview, Florida. The Jacksonville immature example taken in May, as well as that from Fort Reed taken in April, seems to indicate that the species is always immature on those dates.

Distribution.—The Coastal Plain and the adjacent portions of the Piedmont region from North Carolina (exact locality not known) south to north-central Florida (Fort Reed and Merritt), west to western Florida (Crestview) and inland as far as Currahee Mountain and Warm Springs, Georgia. It ranges vertically from sea-level to as high as 1700 feet in favorable localities.

Specimens Examined: 47; 21 ♂, 20 ♀, 3 juv. ♂, 3 juv. ♀.

Florence, South Carolina, IX, 6, 1911, (R. & H.; in short-leaf pine forest), 1 ♀.

Magnolia, South Carolina, IX, 5, 1911, (H.; in long-leaf pine woods), 1 ♀.

Currahee Mountain, Georgia, 1700 feet elevation, VIII, 5, 1913, (H.; in undergrowth of short-leaf pine woods), 1 ♀.

Warm Springs, Georgia, VII, 31, 1910, (J. C. Bradley), 1 ♀, [Ga. State Cln.].

Sandfly, Georgia, IX, 3, 1911, (R. & H.; taken on ground or climbing up in weeds along edge of forest of gray-bark pine), 2 ♂, 1 ♀.

Billy's Island, Okeefenokee Swamp, Georgia, VI, 1912, IX, 1 to 16, 1913, (J. C. Bradley), 11 ♂, 4 ♀, 1 juv. ♂, 1 juv. ♀, [Cornell Univ.].

Spring Creek, Georgia, VI, 7 to 23, 1911, (J. C. Bradley), 1 ♂, [Ga. State Cln.].

Crestview, Florida, X, 15 to 16, 1914, (Lutz and Watson), 1 ♀, [A. M. N. H.].

Tallahassee, Florida, IX, 2, 1915, (R. & H.; on dead leaves around bushes and under tall water oaks on oak and pine clad hill crest), 2 ♂, 6 ♀.

Carrabelle, Florida, IX, 3, 1915, (H.; among bushes on outer border of swampy area), 1 ♂.

Lake City, Florida, 1 ♂,[34] [U. S. N. M.]; VI, 9, 1899, 1 ♀, [Davis Cln.].

Jacksonville, Florida, V, 1885, (Ashmead), 1 juv. ♂, [Hebard Cln.].

Atlantic Beach, Florida, VII, 24, 1911, (R. & H.; on ground under live oak), 1 ♀.

Pablo Beach, Florida, VIII, 11 and 14, 1905, (R. & H.; in palmetto scrub and near edge of salt marsh), 3 ♂, 1 ♀, [Hebard Cln. and A. N. S. P.].[35]

Hastings, Florida, (A. J. Brown), 2 juv. ♀, [Morse Cln.].

Fort Reed, Florida, IV, 17, 1876, (Comstock), 1 juv. ♂ (sex uncertain, abdomen imperfect), [Cornell Univ.].[36]

Merritt, Florida, VII, 15, 1915, (A. R. Moore), 1 ♀, [U. S. N. M.].

Atlanticus dorsalis (Burmeister) (Pl. VI, figs. 17 and 23; pl. VII, figs. 7, 16 and 25; pl. VIII, figs. 9 and 17.)

1838. *D[ecticus] dorsalis* Burmeister, Handb. der Entom., ii, abth, ii, pt. 1, p. 713. [South Carolina[37].]

1905. *Atlanticus gibbosus* Rehn and Hebard (not of Scudder, 1894), Proc. Acad. Nat. Sci. Phila., 1904, p. 797. [Thomasville, Georgia.]

1907. *Atlanticus dorsalis* Caudell, Proc. U. S. Nat. Mus., xxxii, p. 323. (Part.) [Jacksonville, Florida.]

Our association of Burmeister's name with this species is, as in the case of *pachymerus*, a matter of elimination. The present species certainly occurs in eastern South Carolina; a statement we feel warranted to make with our knowledge of the field conditions there and also where the present species has been taken. Of the other species taken near the probable type locality not one would answer the brief description of Burmeister. He particularly mentions that the tegmina of the male sex (the only sex known to him) are hidden under the pronotum, a condition found only in the present species, *gibbosus* and *glaber*. The large *gibbosus* far exceeds Burmeister's measurements and again has the lateral angles of the pronotum well

[34] Reported by Caudell (Proc. U. S. Nat. Mus., xxxii, p. 327, (1907)).

[35] Previously reported by Rehn and Hebard (Proc. Acad. Nat. Sci. Phila., 1907, p. 315, (1907)).

[36] Recorded as *dorsalis* by Scudder (Proc. Boston Soc. Nat. Hist., xix, p. 83, (1877)).

[37] Probably in the vicinity of Georgetown, South Carolina—see footnote 18, page 53.

rounded, while Burmeister's key leading through the text to *pachymerus* and *dorsalis* describes these angles as sharp. The slender bodied *glaber* is found nowhere near South Carolina and would not answer the description on account of the strongly rounded character of the angles of the pronotum. In addition Burmeister would doubtless have mentioned the very peculiar cerci of *gibbosus* or the very slender and unusual form of *glaber* if he had had either form before him. These features would not be noteworthy in connection with the present species.

This species stands quite apart from the other forms of the genus, although it is a member of the *glaber-calcaratus* group. It appears to be sort of a connecting link bridging the gap between this rather aberrant section and the other more coherent units of the genus. The relationship to the *pachymerus* and *americanus* groups is, however, more apparent than real, consisting as it largely does of a similarity in the general form of the dorsum of the pronotum. When we take the features of relationship to *glaber* and *calcaratus*, however, the form of the lateral lobes of the pronotum, the appreciable rounding of the lateral angles of the disk of the same, the character of the male tegmina, *i. e.* form and position, the form of the male cerci and the characters of the distal caudal tibial spurs, we find the real affinity is strongly in that direction.

The form of the pronotum in the two adults before us is very similar, the humeral angle, which is subobsolete in the male, being weakly indicated in the female. The pronotal disk is hardly constricted in form, the width at the cephalic third being hardly less than that at the cephalic margin, the lateral margins weakly diverging on the median third with the caudal third of the disk subequal in width. The greatest width (caudal third) of the disk is 49 (♀) to 57 (♂) per cent of the total length of the same. A faint but appreciable median carina is present on the caudal half of the disk and the lateral angles of the same are somewhat rounded although well defined. The cephalic margin of the disk is very shallowly arcuate—or faintly angulate-emarginate; caudal margin of the same moderately arcuate in the female, approaching subtruncate in the male. The lateral lobes have their greatest depth contained twice in the greatest dorsal length of the same.

The male tegmina project but very slightly caudad of the caudal margin of the pronotal disk, are distinctly vaulted in form with the mirror of the tympanum relatively large. The abdomen has the dorsal and lateral carinae well indicated in both specimens. The disto-dorsal abdominal segment is roundly obtuse-angulate emarginate in the male, more decidedly angulate in the female. The supra-anal plate in both sexes is small, rectangulate, with a medio-longitudinal sulcus. The male cerci are short and robust, the distal portion moderately acute. The male subgenital plate is slightly acute-angulate emarginate, the styles of medium length, slender.[38] The ovipositor of the female is moderately robust and straight, the apex ventral, the length of the ovipositor but little more than two-thirds that of the caudal femur. The subgenital plate of the female is deeply and broadly U-emarginate, the tips of the lateral sections of the plate well rounded. The prosternal spines are of medium length, aciculate; the mesosternal lobes acute, varying in degree in the two specimens, the tips faintly mammillate. Caudal femora elongate, moderately bullate proximad and passing regularly into the slender distal portion, the ventro-internal margin with three to five spines; caudal tibiae with the medio-internal distal spur twice as long as the ventro-internal one.

The immature specimens have an elongate, narrow type of pronotum resembling that of *glaber* and *calcaratus*, but with indications, however, in the outline of the disk of the condition of the adult, while the form of the lateral lobes is distinctly the same. The abdomen is strongly carinate in all these immature individuals.

Color Notes.—Both adults seen are very dull colored, having little contrast, the general dorsal tone being bone brown to fuscous, the pale section of the lateral lobes, venter and genae sayal brown in the female, bister in the male. The face is washed with the dorsal color in both adults. The fuscous of the lateral lobes of the pronotum is restricted to the caudal extension of the lateral lobes and the very narrow edging of the region of the humeral sinus is strongly contrasted. The immature specimens are in general colored much as the adults, the fuscous

[38] The male seen has one style normal, the other is replaced by a heavy incompletely articulated process, apparently an abnormal condition.

of the lateral lobes of the pronotum being more extensive in some few specimens in the second instar preceding maturity. In two immature individuals (♂ and ♀) in the same stage the pronotum and the abdomen bear a median closely placed pair of fuscous lines, such as are frequently seen in *A. glaber*.

Measurements (in millimeters)

	Length of body	Greatest length of disk of pronotum	Greatest (caudal) width of pronotal disk	Length of caudal femur	Length of ovipositor
♂ South Carolina (ex Burmeister)...	22.9			25.4	
♂ Billy's Island, Georgia.....	25.4	10.7	6.1	24.3	
♀ Thomasville, Georgia.	25.7	12.2	6	29.8	20.6

Biological Notes.—From the scanty information available it is seen that the species becomes adult by June and the specimens taken as late as April 9 are in the second instar preceding maturity. The immature individuals taken March 16 are in the third instar preceding maturity, while the December 10 and 18 specimens are extremely small. We should judge the eggs hatch about December 1 (at Thomasville). The species was taken in damp areas in the pine woods.

Distribution.—From South Carolina (exact locality not certainly known) south to northeastern Florida (Jacksonville[39]), west at least to southwestern Georgia (Thomasville).

Remarks.—This species is unquestionably a divergent member of the *glaber* group, the evidence of the immature specimens supporting that found in the adults.

Specimens Examined: 12; 1 ♂, 1 ♀, 7 juv. ♂, 3 juv. ♀.

Billy's Island, Okeefenokee Swamp, Georgia, VI, 1912, (J. C. Bradley), 1 ♂, [Cornell Univ.].

Thomasville, Georgia, XII, 10, 1903, XII, 18, 1908, III, 16 to IV, 9, 1904, (H. and R. & H.; in wire grass in pine woods), 5 juv. ♂, 3 juv. ♀; VII, 23, 1903, (for H.), 1 ♀, [all Hebard Cln. and A. N. S. P.].[40]

Jacksonville, Florida, III, 4, 1905, (H. G. Dyar), 2 juv. ♂, [U. S. N. M.].

[39] Blatchley's record of the young of *Atlanticus pachymerus* from Ormond, Florida (A Nature Wooing, p. 223, (1902)) may refer to this species. See also under *glaber* and *calcaratus*.

[40] Recorded by Rehn and Hebard (Proc. Acad. Nat. Sci. Phila., 1904, p. 797, (1905)) as *A. gibbosus*.

Atlanticus glaber Rehn and Hebard (Pl. VI, figs. 18 and 24; pl. VII, figs. 8, 17 and 26; pl. VIII, figs. 10 and 18.)

1877. *Thyreonotus dorsalis* Scudder, Proc. Boston Soc. Nat. Hist. xix, p. 83. (Part.) [Fort Reed, Florida.]

1905. *Atlanticus* sp. Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1905, p. 48. [Miami and Tampa, Florida.]

1912. *Atlanticus glaber* Rehn and Hebard, *Ibid.*, 1912, p. 269, figs. 20 to 22. [Miami and Homestead, Florida.]

There is little to add to the description of this species, except a few slight amplifications and additions. The pronotum is uniform in shape as described and figured, except that the Marco and several Miami males show no trace of a sinus indentation in the caudal margin of the lateral lobes. The caudal section of the pronotal disk has a trace of a median carina. The tegmina in the male type do not exceed the caudal margin of the pronotal disk, those of a number of the other males in the series slightly surpass the same; the form of the tegmen is characteristic, the mirror of medium size. Disto-dorsal abdominal segment in both sexes nearly rectangulate-emarginate, varying somewhat individually in this respect, the lateral angles bordering the same moderately produced; supra-anal plate of male rectangulate, sometimes with a rotundate tendency, of the female acute-angulate, with a medio-longitudinal sulcus on the greater (proximal) portion of its length. Subgenital plate of male acute- to rectangulate emarginate; styles of medium length, slender. Ovipositor varying slightly in depth and in length, faintly decurved in the Marco female, the apex ventral or submedian. Subgenital plate of the female rather broadly U-emarginate, the lateral angles rotundate-subacute. Caudal femora with four to nine spines on the ventro-internal margin. Medio-internal distal spur of the caudal tibiae slightly more than twice as long as the ventro-internal spur.

Color Notes.—The following notes are supplementary to those given in the original description. The pale dorsal coloration is occasionally (two males, Marco and Miami) entirely uniform pale chestnut (between burnt sienna and chestnut of Ridgway); the same area may bear a closely placed median pair of fine medio-longitudinal lines (weak in allotype, pronounced in Marco female and one Miami male and several immature specimens), while the black maculations on the sides of the abdomen may be

present or absent (female from Marco). The shining black of the lateral lobes of the pronotum varies from strongly indicated and extending over the dorsal section of the lobes to obsolete (Marco female); the pale caudal border is always marked. The male tegmina are very pale maize yellow to sanford brown, lined along the humeral trunk and broadly painted along the sutural margin with blackish fuscous, the mirror outlined with the same. In life the ventral surface of the abdomen is pale lemon yellow (Ridgway). The immature material does not differ essentially from the adults in coloration.

Measurements (in millimeters)

	Length of body	Length of pronotum	Greatest width of disk of pronotum	Length of caudal femur	Length of ovipositor
♂					
Pineland, Florida	27.6	10.7	4.7	26.2	....
Marco, Florida	24.2	11.2	4.7	26.3	....
Miami, Florida, *Type*	31.5[41]	11.5	4.1	25.8	....
Miami, Florida. (Matured in Philadelphia)	24	10.6	4.3	25	....
Miami, Florida. (Matured in Philadelphia.)	27.4	12	4.4	27	....
♀					
Pineland, Florida	27.4	11.7	4.3	28	17.5
Pineland, Florida	29.2	11.3	4.3	28.2	18.2
Marco, Florida	24.5	11.2	4.9	30.2	20.4
Miami, Florida, *Allotype*	32.5[41]	11.8	4.1	28	20

Biological Notes.—From available material it is evident that the present species matures in south Florida by March 16, while the last date we have for adults is May 20. In early February the specimens from that region are about half-grown, while others taken March 6, 16, 17, and 28, as well as one May 18 to 20, are in the instar preceding maturity. The Tampa specimen, January 17, is very small, but clearly referable to this species. The Fort Reed individual, taken April 20, is in the instar preceding maturity.

The species occurs in undergrowth in pine woods and in grasses in meadowy regions within its range.

[41] Body probably slightly overstuffed.

Distribution.—Central[42] and southern Florida; from Fort Reed and Tampa south to the extreme point of the eastern pine belt (Homestead).

Specimens Examined: 28; 10 ♂, 7 ♀, 5 juv. ♂, 6 juv. ♀.

Fort Reed, Florida, IV, 20, 1876, (Comstock), 1 juv. ♀, [Cornell Univ.].[43]

Tampa, Florida, I, 17, 1904, (H.), 1 juv. ♂.

Pineland, Pine Island, Charlotte Harbor, Florida, V, 18 to 20, 1915, (H.; in undergrowth of pine woods), 1 ♂, 5 ♀, 1 juv. ♀.[44]

Marco, Florida, IV, 20 and 21, 1912, (W. T. Davis), 1 ♂, 1 ♀, [Davis Cln.].[45]

Miami, Florida, II, 6 and 9, 1904, (H.), 4 juv. ♂, 2 juv. ♀,[46] III, 6, 1915, (juv. only), III, 16, 1915, (adult and juv.), (H.; rare but widely distributed through undergrowth in pine woods), 1 ♂, 7 juv.♂;[47] III, 28, 1910, (H.), 1 ♂, *type*, 1 ♀, *allotype*, 1 juv. ♀, *paratype*, [Hebard Cln. and A. N. S. P.].

Homestead, Florida, III, 17 to 19, 1910, (H.), 1 juv. ♀, *paratype*.

Atlanticus calcaratus new species (Pl. VI, figs. 1, 19 and 25; pl. VII, figs. 9, 18 and 27.)

This interesting species is a development of the *glaber* type, being much nearer to that form than to *A. dorsalis*. From *A. glaber* the present species can be separated by the shorter pronotum, the truncate caudal margin of the disk of the same, the deeper and shorter lateral lobes of the pronotum, which also have an appreciable indentation at the sinus, the more acute angles of the disto-dorsal abdominal segment, the less exserted and shorter cerci of the male, the subfissate subgenital plate of the same sex, the more robust limbs and the greatly elongate medio-internal distal spur of the caudal tibiae. The prosternal spines are lacking in the available material of *calcaratus*, but as these may be individual in their indication we have refrained from giving this feature as diagnostic.

[42] Blatchley's record of the young of *A. pachymerus* (A Nature Wooing, p. 223, (1902)) may refer to this species. See also under *A. dorsalis* and *calcaratus*.

[43] Recorded by Scudder (Proc. Boston Soc. Nat. Hist., xix, p. 83, (1877)) as *Thyreonotus dorsalis*.

[44] Hebard, Entom. News, xxvii, p. 21, (1916).

[45] See Journ. N. Y. Entom. Soc., xxii, p. 113, (1914).

[46] Proc. Acad. Nat. Sci. Phila., 1905, p. 48, (1905).

[47] The immature specimens were brought north alive and all but one successfully reached maturity April 12 to 24 (See Hebard, Entom. News, xxvi, pp. 459 to 460, (1915)).

Type: ♂; Billy's Island, Okeefenokee Swamp, Georgia. June, 1912. (J. Chester Bradley.) [Acad. Nat. Sci. Phila., Type no. 5275.]

Description of Type.—Size rather small (for the genus); form moderately compressed; surface glabrous dorsad, somewhat polished laterad, on the face and on the limbs. Head with the occiput following the general curve of the dorsum of the pronotum; fastigium, when seen from the lateral aspect, broadly rounding into the moderately retreating line of the face, when seen from the dorsum the fastigium is very broad, the width equal to the greatest depth of the eye, the ventro-lateral margins of the fastigium rectangulate convergent, the ventral extremity faintly produced, narrow, truncate and in full contact with the facial fastigium; eyes subcircular in outline, flattened cephalad, their greatest depth not more than two-thirds that of the infra-ocular portion of the genae; antennae moderately surpassing the apex of the abdomen. Pronotum when viewed from the lateral aspect appreciably arcuate cephalo-caudad, distinctly compressed, the disk narrow, subequal, the greatest caudal width of the disk but 38 per cent of the greatest length of the same, the lateral angles of the disk straight, subparallel, but moderately indicated and well rounded into the lobes; cephalic margin of the disk gently arcuato-emarginate, caudal margin of the disk moderately arcuate, more rounded laterad where it passes into the caudal margin of the lateral lobes, surface of the disk with the faintest possible indication of a median carina; lateral lobes of the pronotum with the greatest depth contained one and three-fourths times in the greatest dorsal length of the same, cephalic margin of the lobes weakly arcuato-emarginate, ventro-cephalic angle broadly rounded obtuse-angulate, ventral margin gently convex, ventro-caudal angle broadly obtuse, caudal margin of the lobes oblique with a distinctly indicated though shallow humeral sinus. Tegmina relatively narrow, projecting nearly a third their length caudad of the caudal margin of the pronotal disk, distal margin well rounded, costal margin nearly straight, marginal field of medium width at base and becoming narrower distad, mirror relatively of medium size, of a subquadrate form. Abdomen distinctly tricarinate, the lateral carinae about as distant from one another as the lateral angles of the pronotal disk, all becoming weaker caudad; disto-dorsal abdominal segment rather deeply acute-angulate emarginate mesad, the lateral angles of the same sharp and acute, the emarginations at the cercal bases strongly contrasted in consequence; supra-anal plate brief, rounded rectangulate, with a median deep longitudinal sulcus in the greater (distal) portion of its length; cerci short, robust, distal extremity subattenuate, acute, very faintly sublamellate on internal margin, tooth median, robust, strongly falcate; subgenital plate relatively narrow, distal margin subfissate mesad, styles slender, terete, faintly longer than the width of the distal margin of the plate. Prosternum unspined; mesosternal lobes acute-angulate with their apices submammillate. Cephalic and median limbs rather short (for the genus). Caudal femora elongate, considerably over twice the length of the pronotal disk, moderately inflated proximad and passing regularly into the slender distal portion, internal margin with four to six spines; caudal tibiae when flexed against the femur slightly shorter than the latter, external

distal spurs with the median one largely straight and twice as long as the ventral one, median internal distal spur very long and straight, about two and one-half times as long as the ventral one and reaching to the distal margin of the metatarsus; caudal tarsi moderately slender, subcompressed.

Female unknown.

Paratype.—In addition to the type we have examined a paratypic male in the Morse Collection, taken at Hastings, Florida, by A. J. Brown.

Measurements (in millimeters)

	Length of body	Greatest length of pronotum	Greatest (caudal) width of pronotal disk	Length of tegmen	Length of caudal femur
♂ Billy's Island, Georgia, *Type*	22.5	10.1	3.9	3.6	23.9
♂ Hastings, Florida, *Paratype*	24.4	10.9	4	5.2	24.8

Color Notes.—The type and paratype are very different in general coloration, but comparison shows this is largely due to the difference in the pale color tone, the type being in a strongly contrasted phase, the paratype in a much less contrasted one. General base color of the type dull mustard yellow (Ridgway) on the head and pronotum and ochraceous tawny on the abdomen and limbs, of the paratype benzo brown to chaetura drab (Ridgway), both fairly solid and little broken by the overlying blackish fuscous. In the type the overlying blackish fuscous is fairly solid on the head, except the dorsum, solid on the lateral lobes on the pronotum, except for the pale ventral and caudal margins of the same, and on the infra-carinal lateral sections of the abdomen it is represented by a dense stippling and a juxtacarinal longitudinal series of deep dorso-ventrad lanceolate markings and several longitudinal series of dots ventrad of the other markings, while on the cephalic and median limbs it is present as a heavy overlying marmoration and on the lateral faces of the caudal femora as a wash which varies in depth, and through which the sculptured pattern is indicated. The paratype shows a blackish fuscous coloration similar to the type

except that the head is not as solidly colored but instead is finely vermiculate with that shade, the pronotal lobes are not as deeply or as solidly washed and the infuscation of the caudal femora is not as solid. The dorsum of the head in the type has a pair of broken closely placed dark medio-longitudinal lines, absent in the paratype. Eyes blackish fuscous (type) to old gold (paratype); antennae russet, becoming fuscous distad. The pale margin of the lateral lobes is similar in shape in both individuals, being broad on the ventral margin and narrowest over the sinus, the ventral section of the pale margin clouded with fuscous and the extreme caudal section occasionally washed with greenish (paratype). Tegmina with the marginal field and extreme proximal portion pale, the base color of the remainder ferruginous, the other veins and cross nervures lined with fuscous, which is solidly the color of the disto-sutural section of the tegmina. The median carina of the abdomen is brokenly lined with fuscous in the type, but almost unmarked in the paratype, which has, however, the dorsal surface of the abdomen finely stippled with the same shade. Venter aniline yellow, in the paratype becoming pyrite yellow distad. Ventral area of the caudal femora washed with yellow ochre to antimony yellow; caudal tibiae with the spines tipped with blackish fuscous.

Morphological Notes.—The two specimens seen fully agree in the morphological features except that the paratype has the subgenital plate less narrowed and the emargination of the distal margin less fissate and shallower than in the type.

Biological Notes.—We know nothing definite regarding the habits or occurrence of the species.

Distribution.—The low coastal region of southeastern Georgia and northeastern Florida.[48]

Specimens Examined: 2 males.

Billy's Island, Okeefenokee Swamp, Georgia, VI, 1912, (J. C. Bradley), ♂, *type*, [A. N. S. P.].

Hastings, Florida, (A. J. Brown), 1 ♂, *paratype*, [Morse Cln.].

[48] Immature specimens recorded as *A. dorsalis* by Blatchley (A Nature Wooing, p. 223, (1902)) from Ormond, Florida, may represent this species. See also under *dorsalis* and *glaber*.

EXPLANATION OF PLATES

Plate VI

Fig. 1.—*Atlanticus calcaratus* new species. Billy's Island, Georgia. Dorsal view of male type). (× 2)

Dorsal outline of disk of pronotum, and tegmina (when projecting). (× 1½)

Fig. 2.—*Atlanticus testaceus* (Scudder). Male. Guthrieville, Pennsylvania.

Fig. 3.—*Atlanticus testaceus* (Scudder). Female. Guthrieville, Pennsylvania.

Fig. 4.—*Atlanticus pachymerus* (Burmeister). Male. Goldsboro, North Carolina.

Fig. 5.—*Atlanticus pachymerus* (Burmeister). Female. Goldsboro, North Carolina.

Fig. 6.—*Atlanticus pachymerus* (Burmeister). Female. Lake Ellis (Havelock), North Carolina.

Fig. 7.—*Atlanticus davisi* new species. Male (*type*). Orange, Virginia.

Fig. 8.—*Atlanticus davisi* new species. Female (*allotype*). Orange, Virginia.

Fig. 9.—*Atlanticus davisi* new species. Female. East Jewett, New York.

Fig. 10.—*Atlanticus monticola* Davis. Male (*paratype*). Linville, North Carolina.

Fig. 11.—*Atlanticus monticola* Davis. Female (*type*). Lake Toxaway, North Carolina.

Fig. 12.—*Atlanticus monticola* Davis. Female. Washington County, Virginia.

Fig. 13.—*Atlanticus americanus* (Saussure). Male. Dias Creek, New Jersey.

Fig. 14.—*Atlanticus americanus* (Saussure). Male. Murphy, North Carolina.

Fig. 15.—*Atlanticus gibbosus* Scudder. Male. Billy's Island, Georgia.

Fig. 16.—*Atlanticus gibbosus* Scudder. Female. Atlantic Beach, Florida.

Fig. 17.—*Atlanticus dorsalis* (Burmeister). Male. Billy's Island, Georgia.

Fig. 18.—*Atlanticus glaber* Rehn and Hebard. Male (*type*). Miami, Florida.

Fig. 19.—*Atlanticus calcaratus* new species. Male (*type*). Billy's Island, Georgia.

Internal distal spurs of caudal tibia. (× 5)

Fig. 20.—*Atlanticus testaceus* (Scudder). Female. Guthrieville, Pennsylvania.

Fig. 21.—*Atlanticus americanus* (Saussure). Male. Murphy, North Carolina.

Fig. 22.—*Atlanticus gibbosus* Scudder. Female. Atlantic Beach, Florida.

Fig. 23.—*Atlanticus dorsalis* (Burmeister). Male. Billy's Island, Georgia.

Fig. 24.—*Atlanticus glaber* Rehn and Hebard. Female (*allotype*). Miami, Florida.

Fig. 25.—*Atlanticus calcaratus* new species. Male (*type*). Billy's Island, Georgia.

Plate VII

Lateral lobe of pronotum. (× 1½)

Fig. 1.—*Atlanticus testaceus* (Scudder). Male. Guthrieville, Pennsylvania.
Fig. 2.—*Atlanticus pachymerus* (Burmeister). Male. Goldsboro, North Carolina.
Fig. 3.—*Atlanticus davisi* new species. Male (*type*). Orange, Virginia.
Fig. 4.—*Atlanticus monticola*. Davis. Female (*type*). Lake Toxaway, North Carolina.
Fig. 5.—*Atlanticus americanus* (Saussure). Male. Dias Creek, New Jersey.
Fig. 6.—*Atlanticus gibbosus* Scudder. Male. Billy's Island, Georgia.
Fig. 7.—*Atlanticus dorsalis* (Burmeister). Male. Billy's Island, Georgia.
Fig. 8.—*Atlanticus glaber* Rehn and Hebard. Male (*type*). Miami, Florida.
Fig. 9.—*Atlanticus calcaratus* new species. Male (*type*). Billy's Island, Georgia.

Outline of detached tegmen of male. (× 2)

Fig. 10.—*Atlanticus testaceus* (Scudder). Guthrieville, Pennsylvania.
Fig. 11.—*Atlanticus pachymerus* (Burmeister). Goldsboro, North Carolina.
Fig. 12.—*Atlanticus davisi* new species. *Paratype*. Orange, Virginia.
Fig. 13.—*Atlanticus monticola* Davis. *Paratype*. Linville, North Carolina.
Fig. 14.—*Atlanticus americanus* (Saussure). Dias Creek, New Jersey.
Fig. 15.—*Atlanticus gibbosus* Scudder. Billy's Island, Georgia.
Fig. 16.—*Atlanticus dorsalis* (Burmeister). Billy's Island, Georgia.
Fig. 17.—*Atlanticus glaber* Rehn and Hebard. *Type*. Miami, Florida.
Fig. 18.—*Atlanticus calcaratus* new species. *Type*. Billy's Island, Georgia.

Outline of left cercus of male. (× 5)

Fig. 19.—*Atlanticus testaceus* (Scudder). Guthrieville, Pennsylvania.
Fig. 20.—*Atlanticus pachymerus* (Burmeister). Goldsboro, North Carolina.
Fig. 21.—*Atlanticus davisi* new species. *Type*. Orange, Virginia.
Fig. 22.—*Atlanticus monticola* Davis. *Paratype*. Linville, North Carolina.
Fig. 23.—*Atlanticus americanus* (Saussure). Dias Creek, New Jersey.
Fig. 24.—*Atlanticus gibbosus* Scudder. Billy's Island, Georgia.
Fig. 25.—*Atlanticus dorsalis* (Burmeister). Billy's Island, Georgia.
Fig. 26.—*Atlanticus glaber* Rehn and Hebard. *Type*. Miami, Florida.
Fig. 27.—*Atlanticus calcaratus* new species. *Type*. Billy's Island, Georgia.

Plate VIII

Lateral outline of ovipositor. (× 1½)

Fig. 1.—*Atlanticus testaceus* (Scudder). Guthrieville, Pennsylvania.
Fig. 2.—*Atlanticus pachymerus* (Burmeister). Goldsboro, North Carolina.
Fig. 3.—*Atlanticus davisi* new species. *Allotype.* Orange, Virginia.
Fig. 4.—*Atlanticus davisi* new species. *Paratype.* Orange, Virginia.
Fig. 5.—*Atlanticus davisi* new species. East Jewett, New York.
Fig. 6.—*Atlanticus monticola* Davis. *Type.* Lake Toxaway, North Carolina.
Fig. 7.—*Atlanticus americanus* (Saussure). Dias Creek, New Jersey.
Fig. 8.—*Atlanticus gibbosus* Scudder. Atlantic Beach, Florida.
Fig. 9.—*Atlanticus dorsalis* (Burmeister). Thomasville, Georgia.
Fig. 10.—*Atlanticus glaber* Rehn and Hebard. *Allotype.* Miami, Florida.

Outline of subgenital plate of female. (× 2)

Fig. 11.—*Atlanticus testaceus* (Scudder). Guthrieville, Pennsylvania.
Fig. 12.—*Atlanticus pachymerus* (Burmeister). Goldsboro, North Carolina.
Fig. 13.—*Atlanticus davisi* new species. *Allotype.* Orange, Virginia.
Fig. 14.—*Atlanticus monticola* Davis. *Type.* Lake Toxaway, North Carolina.
Fig. 15.—*Atlanticus americanus* (Saussure). Dias Creek, New Jersey.
Fig. 16.—*Atlanticus gibbosus* Scudder. Atlantic Beach, Florida.
Fig. 17.—*Atlanticus dorsalis* (Burmeister). Thomasville, Georgia.
Fig. 18.—*Atlanticus glaber* Rehn and Hebard. *Allotype.* Miami, Florida.